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Amphibia Zambesiaca 1. Scolecomorphidae, Pipidae, Microhylidae, Hemisidae, Arthroleptidae

by

J. C. Poynton[1] and **D. G. Broadley**[2]

ABSTRACT

Taxonomy and distribution of members of the genera *Scolecomorphus, Xenopus, Phrynomerus, Probreviceps, Breviceps, Hemisus* and *Arthroleptis* (including *Coracodichus* and *Schoutedenella*) occurring in Botswana, Caprivi, Zambia, Malaŵi, Mozambique and Zimbabwe are detailed and discussed.

INTRODUCTION

This study aims at a coverage of amphibians known to occur in the Flora Zambesiaca area, an area which includes the territories of Botswana, Zambia, Malaŵi, Mozambique and Zimbabwe. For convenience, we have added the eastern Caprivi Strip (east of the Okavango River), Namibia. The total area is some 2 740 000 km^2 in extent. Large tracts are poorly collected or uncollected, and a lack of field data on the amphibians necessarily limits the diagnosis of species to morphological features shown by usually small series. The concept of a 'species' in this study is therefore a somewhat crude exemplification of what Nelson & Platnick (1981 : 11) characterise as 'the species concept actually used in practice: those samples that a biologist can distinguish, and tell others how to distinguish (diagnose)'.

Nelson & Platnick (1981 : 12) define species as 'simply the smallest detected samples of self-perpetuating organisms that have unique sets of characters'. Adopting a similar pragmatic approach, a 'species' in this study is taken to be characterised by the 'unique set of characters' which constitute the 'diagnosis' presented under each species head. The process of identifying such sets carries with it, as Nelson & Platnick (1981 : 9) point out, 'hypotheses about properties and their distribution among organisms'. A 'species' in our usage can in fact be regarded as a hypothesis: a hypothesis about the presence of a reproductively inclusive (and perhaps exclusive) group of amphibians in the Zambesiaca area. Such a hypothesis is patently testable by field studies, physiological investigations and more detailed or extended morphological analysis; and indeed a major value of such a hypothesis is seen to lie in whatever stimulation and facilitation it gives to further investigation of this still poorly known element of the African fauna.

It should be stated at the outset that this study concentrates on the species level, and is not concerned with attempting fundamental assessments regarding the 'higher' classification of the species discussed. The incompleteness of our present

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[1] Department of Biological Sciences, University of Natal, King George V Avenue, Durban 4001, South Africa.

[2] Department of Herpetology, Natural History Museum of Zimbabwe, P.O. Box 240, Bulawayo, Zimbabwe.

knowledge of African amphibians tends to give rise to arbitrary and often idiosyncratic generic and family groupings, which tend rather to generate counterproductive relationships among individual herpetologists than to generate better understanding of relationships among the species themselves. Our generic groupings tend to be conservative and inclusive in the interests of nomenclatural stability; our family groupings follow those of Kluge & Farris (1969) with modifications by Dubois (1981).

The species concept just outlined does not, as Nelson & Platnick point out, distinguish between species and subspecies. The use of the subspecific category has tended to fall increasingly out of favour with taxonomists, but in the Zambesiaca area there are two particular situations where this category has been put to use in the amphibian fauna, and where it could still be defended. One situation is the presence of morphologically very similar taxa on isolated highland areas, such as the generally accepted subspecies of *Rana johnstoni* and *Strongylopus fasciatus* in the highlands of Malaŵi and eastern Zimbabwe. These isolated populations are evidently the relics of wider distributions achieved during a cooler climatic phase, and use of the subspecific category serves the purpose of emphasising this particular phylogenetic and biogeographical affinity. The other situation where the subspecies category has been commonly used is in treating units of an apparent stepwise cline, as in the *Hyperolius marmoratus* complex.

The advantage of these usages of the subspecies category is that such clusterings of taxa are reflected in the nomenclature. The commonly used alternative is to treat a cluster of taxa as a superspecies and its constituent taxa as semispecies, particularly if the taxa show hybrid zones (White 1981). All constitutent taxa would then be given specific rank, which means that the nomenclature is not able to reflect the clustering.

When having to choose between alternatives such as these, Snow (1981:36) makes a realistic comment that 'there always comes a point where a more or less arbitrary decision must be made, and different taxonomists will decide in different ways'. Consequently, our taxonomic arrangements are not made in the expectation that other herpetologists will necessarily follow our treatment of complexes such as those involving *Breviceps mossambicus, Hemisus marmoratum* and *H. guineensis, Rana johnstoni, Strongylopus fasciatus, S. grayii* and *Hyperolius marmoratus*.

It is planned to publish *Amphibia Zambesiaca* in four parts. Part II will cover the Ranidae, Part III the Rhacophoridae and Hyperoliidae, and Part IV the Bufonidae, together with a general zoogeographical section. The references included in the tables of synonymy cover literature specifically dealing with amphibians of the Zambesiaca area, and not elsewhere in Africa. Literature locality records are included only if the material referred to has not been examined by us, but seems to be reliably identified; the locality lists following each species section are based on material examined by us, and the museum abbreviations are: AJL—private collection of Mr Lambiris, Durban; AM— Albany Museum, Grahamstown; AMNH— American Museum of Natural History, New York; BM—British Museum (N.H.), London; CRP—private collection of Mr Parry, Harare; DM—Durban Museum; FMNH—Field Museum of Natural History, Chicago; JV—private collection of Mr Visser, Cape Town; MCZ—Museum of Comparative Zoology, Cambridge Mass.; MM—McGregor Museum, Kimberley;

NM—Natal Museum, Pietermaritzburg (which includes UN material in Poynton 1964 from south of the Zambezi); NMB—Nasionale Museum, Bloemfontein; NMZB—Natural History Museum of Zimbabwe, Bulawayo (which includes RM material in Poynton 1964 and material subsequently designated UM); NMZL — National Museum, Livingstone (which includes LM material in Poynton 1964); PEM—Port Elizabeth Museum; RG—Musée Royal de l'Afrique Centrale, Tervuren; SAM—South African Museum, Cape Town; TM—Transvaal Museum, Pretoria (which includes UN material in Poynton 1964 from north of the Zambezi); USNM—National Museum of Natural History (Smithsonian Institution), Washington; ZMB —Zoologisches Museum, Berlin; ZMC— Zoologisk Museum, Copenhagen.

This study deals almost exclusively with the postmetamorphic phase of Zambesiaca amphibians, since virtually no collecting of tadpoles has been done in the area. The omission of larval stages underlies the general incompleteness of our present knowledge, and it is hoped that this study will act as a stimulus for more work on life histories, particularly of those species endemic or largely confined to the Zambesiaca area.

SYSTEMATIC LIST

	Recorded occurrence						*Page*
Species	Botswana	Caprivi	Zambia	Malaŵi	Mozambique	Zimbabwe	
Scolecomorphidae							
Scolecomorphus kirkii Boulenger				●			506
Pipidae							
Xenopus laevis laevis (Daudin)	●			●	●	●	507
Xenopus laevis petersii Bocage	●	●	●			●	508
Xenopus muelleri (Peters)	●	●	●	●	●	●	511
Microhylidae							
Phrynomerus bifasciatus bifasciatus (Smith)	●	●	●	●	●	●	513
Phrynomerus affinis (Boulenger)			●				514
Probreviceps rhodesianus Poynton & Broadley						●	516
Breviceps mossambicus Peters	●		●	●	●	●	517
Breviceps adspersus Peters	●	●	●		●	●	523
Breviceps poweri Parker			●	●	●		525
Hemisidae							
Hemisus marmoratum marmoratum (Peters)	●	●	●	●	●	●	529
Hemisus guineensis broadleyi Laurent			●		●	●	532
Hemisus guineensis microps Laurent	●	●	●				533
Hemisus wittei Laurent			●				535
Arthroleptidae							
Arthroleptis stenodactylus Pfeffer			●	●	●	●	536
Arthroleptis francei Loveridge				●			538
Arthroleptis reichei Nieden				●			539
Arthroleptis troglodytes Poynton						●	539
Arthroleptis xenochirus Boulenger			●	●			540
Arthroleptis xenodactyloides Hewitt			●	●	●	●	542

Family SCOLECOMORPHIDAE

Body worm-like, no front or hind limbs, no tail, no scales. The family was proposed by Taylor (1969) to contain one African genus formerly included in the Caeciliidae.

Genus *Scolecomorphus* Boulenger

Scolecomorphus Boulenger, 1883 : 48. Type by monotypy: *S. kirkii* Boulenger.

Tentacle flap-shaped, situated below and slightly behind nostril, surrounded by a groove into which the eye may be pulled; penis with spines; wide palatine-prevomerine diastema.

Six species recognised by Taylor (1968, 1969), all occurring in tropical Africa, mainly in the east. Burrowing and viviparous (Wake 1977).

Scolecomorphus kirkii Boulenger

Scolecomorphus kirkii Boulenger, 1883 : 48. Type locality not specified. Holotype in the British Museum (N.H.), London. Günther 1892 : 555, Boulenger 1895 : 413, Johnston 1897 : 362 & 1898 : 361, Pitman 1934 : 311, Mitchell 1946 : 33, Taylor 1968 : 643 & 1969 : 297.

Scolecomorphus k. kirkii Boulenger, Loveridge 1953*a* : 332, Poynton 1964*b* : 196, Stewart 1967 : 21, Stevens 1974 : 5.

Diagnosis. Length 33–45 times width; 129–148 primary folds; about 20 premaxillary–maxillary teeth, 30 dentary teeth.

Description. Maximum recorded size 451 mm (Loveridge 1953*a*). Colour in life: 'Above, glossy black; sides brownish. Below, white anteriorly becoming—towards midbody—minutely speckled with pink, the specks so concentrated posteriorly as to produce a general pink appearance' (Loveridge 1953*a* : 333). In alcohol: above, olive-violet to olive-brown, lighter towards the sides; below a yellowish-brown.

Habitat. Collected just below forest on Thyolo Mountain (Loveridge 1953*a*).

Remarks. Loveridge (1953*a*) stated that Dr G. Arnold 'told me in 1949 that some years ago he came upon the remains of a partly digested caecilian, possibly dropped by a bird, on Mount Gomo, popularly known as Mount Pork Pie, lying to the west of Melsetter, Southern Rhodesia' (ie. Chimanimani, Zimbabwe). So far, the existence of a caecilian in Zimbabwe has not been confirmed, and the identification of Arnold's 'partly digested' specimen now seems in doubt.

Distribution. Malaŵi, southwestern highlands of Tanzania, 'probably about Lake Tanganyika' (museum record for holotype).

Localities. MALAŴI. Thyolo Mountain (NMZB), Zomba Plateau (BM). Shire Highlands (Günther 1893).

Family PIPIDAE

Tongue absent; eustachian tubes open into the pharynx through a single median aperture. Epicoracoids of pectoral girdle overlap narrowly. Tadpoles with paired spiracles and barbels, lacking denticles. Amplexus inguinal. A highly aquatic family of amphibians: Sokol (1977) has discredited the tradition of according primitive status to members of this family, stating (we believe correctly) that 'most of their character complexes are either derived or highly derived'. The family evidently has had a long history of independent evolution, but it is a non sequitur to argue from this that the family should necessarily be viewed as 'archaic' (eg. Tinsley 1981).

Restricted to tropical South America and Africa south of the Sahara. Three genera occur in Africa, one of which (*Xenopus*) is represented over almost all of subsaharan Africa, and is known from Palaeocene and Eocene South America (Estes 1975).

Genus *Xenopus* Wagler

Xenopus Wagler 1827 : 726. Type by monotypy: *X. boiei* Wagler = *Bufo laevis* Daudin.

Platannas or Clawed Toads. Toes fully webbed, first three toes each terminating in a hard, black claw. Stitch-like lateral line organs present.

Most of Africa south of the Sahara. Almost completely aquatic, both feeding and breeding underwater, but moving overland at times. A scavenger as well as predator, large pieces of food being held in the mouth and shredded by forward raking movements of the clawed hind limbs. Tadpoles are filter-feeders with a tendency to form shoals.

Key to the Zambesiaca species and subspecies of *Xenopus*

1	Subocular tentacle much shorter than half orbital diameter	2
—	Subocular tentacle at least half orbital diameter	**muelleri**
2	Ventral surface immaculate, sometimes with light speckling	**laevis laevis**
—	Ventral surface speckled to heavily marked with black blotches	**laevis petersii**

Xenopus laevis laevis (Daudin)

Bufo laevis Daudin, 1802 : 85, pl. 30, fig. 1. No type locality. Type apparently lost.
Xenopus laevis (Daudin); Boulenger 1902 : 15, Parker 1930 : 905, FitzSimons 1935 : 379.
Xenopus laevis laevis (Daudin); Parker 1936 : 597 & 1956 : 11, Mertens 1937 : 17, Poynton 1964*a* : 29 & 1964*b* : 196 & 1982 : 67, Stewart & Wilson 1966 : 297, Stewart 1967 : 23, Stevens 1974 : 5, Vigny 1979*a* : 104 & 1979*b* : 877.

Diagnosis. Subocular tubercle shorter than half orbital diameter, inner metatarsal tubercle raised into a narrow ridge. Width of nostril divided by internarial space gives the proportion 0,8 or more; number of transverse bars of the lateral line between eye and vent not less than 23 (in the Zambesiaca area).

Description. Attaining a size of over 100 mm. Head obtusely pointed, more obtuse in adults. Ventral surface typically immaculate silvery, but light speckling and yellow or orange infusions present as variation in large part of range.

Habitat. Common in most plateau rivers, lakes, flooded pits and wells.

Remarks. Mergence with *l. petersii* is described under that form. NMZB material from Maun and Ruware is difficult to refer either to *l. laevis* or *muelleri*. Hybridisation between *laevis* and *muelleri* can be achieved (Wall & Blackler 1974), but available field data indicate that the forms generally behave as good species.

Distribution. All southern Africa excluding most of the Mozambique Plain, most of Botswana, and northern Namibia. Relict populations occur on Inhaca Island, and the Shire and Nyika areas of Malaŵi.

Localities. BOTSWANA. Lobatse (MM), Metsemotlhaba River (TM). MALAŴI. Lujeri Estate, Mulanje (NMZB), Thyolo Mountain (NMZB). Blantyre; Thyolo; Limbe; Zomba; Mnema, Ntchisi Mountain (Loveridge 1953*a*). Nyika Plateau; Nchenachena; Likabula Rest House on Mulanje (Stewart 1967). Lirangwe River (Stevens 1974). MOZAMBIQUE. Amatongas (BM), Chemezi (NMZB), Estatuane (NMZB), Garuso (NMZB), Inhaca Island (NMZB, TM), Meponduine (NMZB), Martins Falls (NMZB), Mavita (NMZB), 20 km SW Mungari (NMZB), Namaacha (NMZB). ZIMBABWE. Ambi Falls (NMZB), Atlantica (AJL, NMZB), Bembezi (NMZB), Bikita (NMZB), Bulawayo (NMZB), Bundi River (NMZB), Cashel (NMZB), Chimanimani Mountains East (NMZB), Chinyamanda (NMZB), Chishawasha (SAM), Chizarira Range (NMZB), Cleveland Dam (NMZB), Driefontein (AM), Dunblane (NMZB), Fern Valley (NMZB), 18 km ESE Guruve (NMZB), Gwanda (NMZB), Harare (NMZB), Haroni River (NMZB), Hwange (NMZB), Inyanga, Rhodes Estate Office (NMZB), Kadoma (AJL), Kapami (NMZB), Karoi (NMZB), Kutama Mission (AJL), Kwekwe (NMZB), Kyle Dam (NMZB), Lake Alexander (NMZB), Lake McIlwaine (NMZB), Leopard Rock (AJL, NMZB), Macheke (NMZB), Maleme Dam (NMZB), Malonga River Bridge (NMZB), Manzituba Camp (NMZB), Marondera (NMZB), Mazoe (NMZB), Melfort (NMZB), Miami (NMZB), Monte Cassino (NMZB), Mount Selinda (TM), Mutare (NMZB), 8 km W Mutoko (NMZB), Mvurwi (NMZB), Nyamazi (NMZB), Nyazura (NMZB), Pachanza (NMZB), Patchway Mine (AJL), Plumtree (AM), Rukute Farm (NMZB), Ruware (NMZB), Selborne (NMZB), Sengwa River (NMZB), Somabhula (NMZB), Sote Source (NMZB), Stapleford (NMZB), The Corner (NMZB), Thorn Park (NMZB), Tynwald (NMZB), Vumba Mountain (NMZB).

Xenopus laevis petersii Bocage

Xenopus petersii Bocage, 1895 : 187. Angola. Types destroyed in the Museu Bocage, Lisbon.
Xenopus laevis petersi Bocage; Parker 1936 : 597 & 1956 : 11, Blackler & Fischberg 1968 : 1023, Vigny 1979*a* : 104 & 1979*b* : 877.
Xenopus poweri Hewitt, 1927 : 413, pl. 24, fig. 3. Victoria Falls. Holotype in the MacGregor Museum, Kimberley. Mertens 1937 : 17.
Xenopus laevis poweri Hewitt; Poynton 1964*a* : 32 & 1982 : 67, Broadley 1971 : 108.

Diagnosis. Subocular tubercle shorter than half orbital diameter, inner metatarsal tubercle raised into a narrow ridge. Width of nostril divided by internarial space gives a proportion of less than 0,8; number of transverse bars of the lateral line between eye and vent not more than 24.

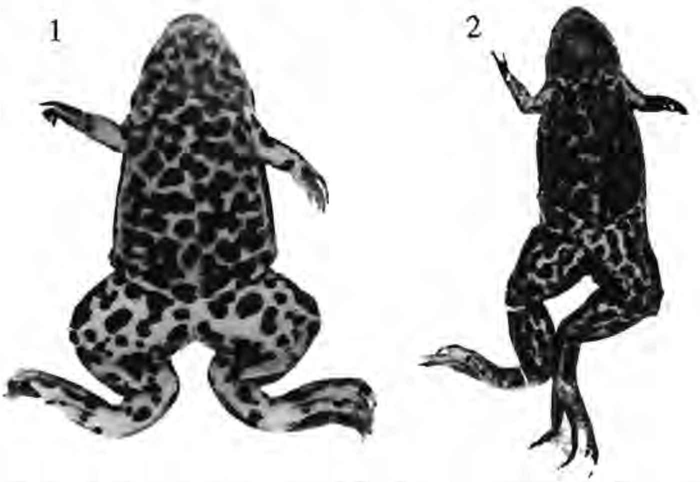
Description. Not known to exceed 80 mm. Head obtusely pointed, more obtuse in adults. Ventral surface speckled to heavily marked with black blotches, more pronounced in juveniles than adults. Usually with orange-brown infusions.

Habitat. Common in rivers, lakes, flooded pits and wells.

Remarks. When describing *petersii*, Bocage (1895) listed three 'Variétés principales', based mainly on differences in ventral markings. He gave no indication that this variation was geographical, but Schmidt & Inger (1959) reported that in the Field Museum Angolan material, 12 specimens from northern Angola showed Bocage's 'Var. A' pattern of (as they conceived it) 'large dark ventral spots sharply defined by light reticulation', while 5 southern Angolan specimens showed the 'Var. B' feature of 'extremely dense pattern of small isolated spots' or a 'fine dark ventral vermiculation' (p. 8). They accordingly restricted *petersii* to 'Var. A', representing a supposedly northern form of *laevis*, and referred 'Var. B' and all southern Angolan, Zambian and Upemban material to *poweri*. They made no reference to Bocage's 'Var. C', 'sans taches ou présentant quelques petites taches'.

Schmidt & Inger did not examine Bocage's material (Inger in litt.), and the material is now destroyed, apparently without the question ever having been investigated that Bocage's 'varieties' have a geographical basis. Poynton (1964*a*) supported Schmidt & Inger's proposal, mainly on the grounds that in near-topotypic material of *poweri*, 'the belly varies from being virtually immaculate to being heavily spotted, although no specimen shows the degree of heaviness illustrated in Schmidt & Inger's figure of *l. petersi*' (p. 33). This assessment of variation was based mainly on a series of 35 NMZB specimens taken from a single gravel pit 7 km west of Livingstone. However, more recently collected material shows a greater range in variation in southern populations than was suspected. For example, a NMZB series from Maun contains, in addition to more finely speckled specimens, two specimens matching Schmidt & Inger's figure of *petersii* with large, very well-defined dark spots, at least one diameter attaining the interorbital width (Fig. 1). A TM series of 15 specimens from Nokaneng shows an even greater range of variation: a heavily marked specimen is shown in Fig. 2.

Certainly this degree of variation is not indicated by many of the series now available. Relative uniformity may be shown, but even this may be of a kind that makes Schmidt & Inger's separation unworkable. A TM series of five specimens from Sepopa, Botswana, all have large, distinct dark blotches characteristic of 'Var. A', supposedly restricted to northern Angola. A series of 14 specimens from Kalabo keeps fairly uniformly to one type of marking, but it seems to fall between Schmidt & Inger's *poweri* and *petersii*. The study of Vigny (1977) has revealed no characters to distinguish *poweri* from *petersii* apart from ventral pigmentation, 'elle-même soumise aux variabilités individuelles et locales' (p. 89). The larger amount of material that we have examined presents a type of variation in ventral markings that seems to blur any workable separation into two forms.



Figs 1–2. *Xenopus laevis petersii* 1. Maun (NMZB 10671). 2. Nokaneng (TM 30740). Natural size.

Bearing in mind the great range of variation in ventral markings shown in *l. laevis* and (more markedly) in other species such as *muelleri* and *wittei* (Tinsley, Kobel & Fischberg 1979), it is not surprising that ventral markings should fail to be of taxonomic use now that a fair amount of *petersii* material is to hand. It may be noted that Hewitt did not consider *petersii* when describing *poweri*.

In laboratory crosses between *petersii* and *laevis*, Blackler & Fischberg (1968) concluded that the two forms are 'true subspecies' without 'any incompatibility between the genotypes'. The markings of *petersii* proved to be dominant over those of *laevis*, but no adult morphological features were investigated. The subspecific relationship between *petersii* and *laevis* is confirmed in the field by what appear to be intermediate specimens from upland areas of southern and north-eastern Zambia, where relic pockets of the more temperate *laevis* could be expected. An 80 mm specimen from Chilanga (NMZB 2666) has lateral line counts of 25 and 26 and a whitish, immaculate belly, all giving the appearance of *laevis*, but the narial/internarial ratio is 0,7 (0,8 or more in *laevis*). To the north, a specimen from Mbala (NMZB 25771) has a narial/internarial ratio of 0,5, well within the *petersii* range, but 26 and 26 lateral line bars, well within the *laevis* range. The ventral surface is whitish, with grey speckles. A specimen from Senje Hill, Isoka (NMZB 21681) has a narial/internarial ratio of 0,85 and a lateral line count of 26 and 26, placing it within the range of *laevis*, but the ventral skin has a faint orange tinge and is heavily speckled, more like *petersii* than *laevis*.

Cases such as these, it may be noted, suggest that the tendency to lighter ventral markings in Zambian populations of *petersii* could be better interpreted as *petersii–laevis* intergradation than as grounds for attempting to recognise *petersii* and *poweri* as distinct taxa. The variation already noted in ventral markings of the Maun series can best be interpreted in this way, and this interpretation is supported by morphological ambiguity such as shown in NMZB 10668, with a narial/internarial ratio of 0,4 (*petersii*) and lateral line count of 25 and 23 (*laevis*).

Distribution. South-western Tanzania, southern Zaïre, Zambia, north-western Zimbawe, northern Botswana, northern Namibia, Angola.

Localities. BOTSWANA. 24 km NE Gumare (NMZB), Khwai River (NMZB), Mahupa Waterhole (TM), Maun (NMZB), Nokaneng (TM), Sepopa (TM). CAPRIVI. Katima Mulilo (TM). ZAMBIA. Bilibili Hot Spring (NMZB), Chinsali (BM), Chunga (NMZB), Dambwa (NMZB), Dem River Farm (NMZB), Kalabo (FMNH, NMZB), Kalomo (NMZB, NMZL), 6 km W Livingstone (NMZB, NMZL), Lochinvar (NMZB), 8 km E Lusaka (BM), Mbala (NMZB), Monze (NMZL), Sandaula Plain (NMZB), Senje Hill (NMZB). Nsombo, Lake Bangweulu (Mertens 1937). ZIMBABWE. Victoria Falls (MM, NMZB).

Xenopus muelleri (Peters)

Dactylethra muelleri Peters, 1844 : 37. Mozambique (restricted to Tete by Loveridge 1953*a*). Types in the Zoologisches Museum, Berlin.

Xenopus muelleri (Peters); Peters, 1882 : 180, pl. 25, fig. 3, pl. 26, fig. 12, Parker 1930 : 905, Hoffman 1944 : 173, Loveridge 1953*a* : 335 & 1953*b* : 144, Poynton 1964*a* : 33 & 1964*b* : 197 & 1966 : 14 & 1982 : 67, Stewart 1967 : 26, Broadley 1971 : 108, Stevens 1974 : 5, Vigny 1979*a* : 109.

Diagnosis. Subocular tentacle at least half the orbital diameter, inner metatarsal tubercle papillate.

Description. Not known to exceed 80 mm. Head fairly acutely pointed. Ventral surface almost immaculate creamy-white to heavily spotted, with or without overall yellowing.

Habitat. Common in lowland rivers, lagoons and pans.

Remarks. Rare cases of apparent intergrades between *muelleri* and *l. laevis* are noted under *laevis*. The zone of sympatry between *muelleri* and *laevis* is usually narrow, with the populations not necessarily in actual contact: at Mutare, *muelleri* seems to occur only in the sewerage works ponds, while the adjacent streams are occupied by *l. laevis*.

Distribution. Mozambique Plain and its fringes, lower Limpopo Basin, Zambezi Basin and Okavango swamps, Malaŵi (excluding uplands) northwards to Sudan, westwards to Ghana and Upper Volta.

Localities. BOTSWANA. Boro River (TM), Four Rivers Camp (NMZB), 24 km NE Gumare (NMZB), Khumaga (NMZB), Khwai River (NMZB), Maun (NMZB), Xaxaba (NMZB), Xhenga Island (TM). CAPRIVI. Old Sangwali (TM). ZAMBIA. Chakwenga River (NMZB), Chipangali (NMZB), Chiwanda (BM), Kalabo (FMNH), Kalichero (NMZB), Kalikali–Kongwe (NMZB), Katete–Lupande (NMZB), Livingstone (NMZL), Luembwe–Luangwa (NMZB), Maiyumba (BM), Mkanda area (NMZB), Mporokoso (PEM), Munyamadzi River (BM), Mweru Wantipa (TM), Nyamkolo (BM). MALAŴI. Chitala (NMB), Karonga–Kondowe (BM), Mchanga (NMZB), Mpatamanga Gorge (NMZB), Ngara (NMZB), Nkhata Bay (NMZB), 'Nyika Plateau' (BM, see Loveridge 1953*a* : 326), Nyungwe (NMZB), Chitala River; Mtimbuka; Chikwawa; Nsanje (Loveridge 1953*a*). Mpatamanga Gorge (Loveridge 1953*b*). Chitipa; Karonga; Bwaye River;

Nkhata Bay; Nkhota Kota; Palm Beach (Stewart 1967). Mulanje dist. (Stevens 1974). MOZAMBIQUE. Amatongas (BM), Beira (NM), Boane (NMZB), Boror (NMZB, ZMB), Buzi River, 22 km E Gogoi (NMZB), Cabaceira Peninsula (NMZB, ZMB), Chambajojo (NMZB), Chimonzo (NMZB), Dondo (NMZB), 10 km E Estatuane (NMZB), Fambani River (BM), Garuso (NMZB), Guro (NMZB), 10 km W Inhassoro (NMZB), Lagoa do Alves de Lima (NMZB), Macuti (NMZB), Manga (NMZB), Massangena (NMZB), Metambanhe (NMZB), Mhanda (NMZB), Mitucué Mountain (NMZB), Moamba (TM), Mossuril (ZMB), Muda (NMZB), Quelimane (ZMB), 10 km SSE Ressano Garcia (NMZB), Savane (NMZB), Sena (ZMB), Tete (ZMB), Vila Bocage (NMZB), Vila Fontes (NMZB), Zinave (NMZB), nr. Boroma (Loveridge 1953*a*). ZIMBABWE. Buffalo Bend Pan (NMZB), Chiredzi (NMZB), Chitza (NMZB), Chivirira Falls (NMZB), Chizarira Range (NMZB), Devure River Bridge (NMZB), Ebony Farm (NMZB), Fishan (NMZB), Gem Farm (AJL), Kariba Lake, Sonda Estuary (NMZB), Kazuma Pan (NMZB), Lundi River Bridge (NM), Makado (NMZB), Makosa (NMZB), Mana Pools (NMZB), Marhumbini (NMZB), Mount Darwin (AJL), Msari River (NMZB), Mubagwahse (NMZB), Mutare (NMZB), 6 km W Mutoko (NMZB), Mwenezi River (NMZB), Nottingham Ranch (NMZB), Nyadekese Dam (NMZB), Razi Dam (NMZB), Ruware (NMZB), Sabi–Lundi Confluence (NMZB), Sengwa Gorge (NMZB), Shashi Irrigation Scheme (NMZB), Ume Confluence, Lake Kariba (NMZB), Victoria Falls (NMZB), Zambezi–Chewore Confluence (NMZB).

Family MICROHYLIDAE

Firmisternal pectoral girdle. Teeth absent (in southern African forms), narrow mouth opening, ridge-like folds or glandular patches on palate. Tadpoles lacking denticles, with a midventral spiracle. A mainly tropical family with a tendency towards burrowing or tree-living, more diverse in southeast Asia and Madagascar than in Africa (Parker 1934). Three genera are known to occur in the Zambesiaca area, but *Spelaeophryne* Ahl, known as far south as Mahenge in Tanzania (Poynton 1977), should be looked for in northern Mozambique.

Key to the Zambesiaca Microhylidae

1 Inner metatarsal tubercle spade-like, length greater than length of third toe 4

— Inner metatarsal tubercle not forming a sharpened flange, length less than length of third toe 2

2 Outer metatarsal tubercle conspicuous, at least ¾ length of inner .... **Probreviceps rhodesianus** (p. 516)

— No discernable outer metatarsal tubercle 3

3 Tips of fingers expanded into truncated discs .... **Phrynomerus bifasciatus** (p. 513)

— Tips of fingers not expanded into discs .... **Phrynomerus affinis** (p. 514)

4 No light paravertebral or dorsolateral spots or patches .... **Breviceps mossambicus** (p. 517)

— At least a series of light dorsolateral patches 5

5 Series of both paravertebral and dorsolateral light spots and patches present .... **Breviceps adspersus** (p. 523)
— Only a series of light dorsolateral spots or patches present 6
6 No conspicuous light patch above vent ....
Breviceps mossambicus × adspersus hybrids (p. 520)
— Conspicuous light patch above vent .... **Breviceps poweri** (p. 525)

Genus *Phrynomerus* Noble

Brachymerus Smith (not Dahlbom), 1847: pl. 63. Type by monotypy: *B. bifasciatus* Smith.
Phrynomantis Peters (part), 1867: 35 (new name for *Brachymerus* Smith, preoccupied, type: *P. fusca* Peters).
Phrynomerus Noble, 1926: 20 (new name for *Brachymerus* Smith after dividing *Phrynomantis* Peters, type: *bifasciatus* Smith).

Inner metatarsal tubercle weakly developed, no outer metatarsal tubercle. Last phalanx of fingers placed more or less out of linear alignment by an intercalary cartilage. Smooth skin. A large glandular mass over posterior region of urostyle (in species here considered) and aposematic coloration.

Eggs laid in water, calling done at ground level even though there is a strong tendency towards clambering during foraging. A small genus occurring in subsaharan savannas, with one form (*annectens*) entering the Namib.

Phrynomerus bifasciatus bifasciatus (Smith)

Brachymerus bifasciatus Smith, 1847: pl. 63. 'Country to the east and north-east of the Cape Colony.' None of the four specimens in the BM collected by Andrew Smith corresponds exactly with Smith's description or figures (FitzSimons 1937). These specimens can, however, effectively be treated as syntypes.
Dendrobates inhambanensis Bianconi, 1849 (1848): 107, pl. 5. Inhambane, Mozambique (presumably). Bianconi 1850: 26, pl. 5, figs. 4, 4a.
Phrynomantis bifasciata (Smith); Peters 1867: 35 & 1882: 172, pl. 26, fig. 9, Boulenger 1907*a*: 480 & 1907*b*: 5, Power 1926: 110.
Phrynomerus bifasciatus (Smith); Power 1927: 415, FitzSimons 1935: 396, Rose 1962: 68.
Phrynomerus bifasciatus nyasalandensis Hoffman, 1944: 181, fig. 9. 'Chitiala', ie. Chitala River, Malaŵi. Holotype in the National Museum, Bloemfontein.
Phrynomerus bifasciatus bifasciatus (Smith); Loveridge 1953*a*: 395 & 1953*b*: 150, Poynton 1964*a*: 85 & 1964*b*: 200 & 1966: 17, Stewart 1967: 44, Broadley 1971: 111, Stevens 1974: 6.

Diagnosis. Tips of toes and especially fingers dilated into discs, truncated anteriorly, and markedly out of alignment with rest of digit. Canthus rostralis angular. Typically a banded pattern on back without a scattering of dorsal spots; no light spots on upper jaw (rarely two or three).

Description. Not normally exceeding 65 mm. Typically a red to pinkish (fading to white) dorsolateral band, starting on canthus, broadening over upper eyelid and continuing to near leg insertion, and a large urostylar patch. In Malaŵi especially, bands tend to be broad, more like juvenile pattern (cf. Power 1927), usually streaked or stranded and sometimes forming a dorsal band (Rose 1962, fig. 43).

Habitat. A fossorial and clambering species, often found in termitaria or other burrows, in rock clefts, in rotting stumps, under logs, rocks or piles of rubble. Sometimes it clambers up tree trunks to shelter in crevices in the bark (especially in baobabs) or in axils of banana trees. Breeds in open pans, vleis or pits, often only temporarily filled. Calling is done at ground level just above the water's edge.

Distribution. Northern Natal, northern Transvaal, extreme northern Cape, northern Namibia, savanna areas northwards to Kenya.

Localities. BOTSWANA. Francistown (TM), 64 km NW Francistown (NMZB), Gumare (NMZB), Kwikampa (NMZB), Khwai River (NMZB), Lobatse (MM), Masalanyane Pan (NMZB), Metsemotlhaba River (TM), Okavango Delta (TM), Palapye Road (AM, SAM), Shashi/Simukwe Confluence (NMZB), Tutume (TM), 16 km N Tobane (NMZB), Tshilonyane Pan (NMZB). CAPRIVI. Katima Mulilo (TM). ZAMBIA. Dimba (NMZB), Livingstone (AMNH, BM, NMZL), Lukasashi River (BM), Mulanga (NMZB), Ngoma, Kafue N.P. (NMZB). MALAŴI. Chiromo (NMB), Chitala (NMB), Lilongwe (NMZB), Limphasa Dambo (NMZB), 'Nyika Plateau' (BM, see Loveridge 1953*a* : 326), Shire Valley (BM), Zomba (BM), Chikwawa; Mangochi; Nsanje (Loveridge 1953*a*), Nchalo (Loveridge 1953*b*). MOZAMBIQUE. Amatongas (NMZB), Bazaruto Island (NMZB), Beira (BM), Boane (NMZB), Chitengo (NMZB), Inchope (NMZB), Luala River Bridge (NMZB), Magasso (NMZB), Maputo (MM), Massangena (NMZB), Metuchira (NMZB), Mossuril (NMZB), Muandzane District (NMZB), Muda–Lamego (NMZB), 10 km SSE Ressano Garcia (NMZB), Tete (ZMB), 25 km NW Vila Franca do Save (NMZB), Xiluvo (NMZB). ZIMBABWE. Antelope (NM), Atlantica (AJL), Bembezi (NMZB), Buffalo Bend Pan (NMZB), Bulawayo (NMZB), 24 km NW Bulawayo (NMZB), Chibi (NM), Chilimanzi (MM), Chiredzi (NMZB), Chivake River Bridge (NMZB), Cyrene Dam (NMZB), Fairfield (NMZB), 11 km N Featherstone (AJL), Gem Farm (AJL), Harare (MM, NMZB), Hwange (NMZB), Inyanga District (NMZB), Inyati C.L. (NMZB), Irisvale (NMZB), Jalopi River (NMZB), Kariba (NMZB), Katombora (NMZB), Linkwasha (NMZB), Longueville Ranch (NMZB), Lundi River Bridge (NM), Lupane (NMZB), Mabalauta F.S. (NMZB), Mahenya (NMZB), Main Camp, Hwange N.P. (NMZB), Majinji Pan (NMZB), Makado (NMZB), Malugwe Pan (NMZB), Mhangura (NMZB), Manzituba Camp (NMZB), Marhumbini (NMZB), Mazoe Dam (NMZB), Mount Hampden (NMZB), Murewa (NMZB), Mutare (NM, NMZB), Mutoko (NM), 51 km NE Mutoko (NMZB), Mwenezi (NMZB), Nyakasikana (NMZB), Nyamandhlovu Pan (NMZB), Plumtree (MM), Pungwe View (NMZB), Rukute Farm (NMZB). Shangani River (BM), Teaklands (NMZB), Victoria Falls (TM).

Phrynomerus affinis (Boulenger)

Phrynomantis affinis Boulenger, 1901 : 6, pl. 2, figs. 5–5d. Pweto, Lake Mweru, Zaïre. Holotype in the Musée Royal de Afrique Centrale, Tervuren.
Phrynomerus affinis (Boulenger); Poynton 1964*a* : 86, Broadley 1971 : 112.

Diagnosis. Tips of fingers and toes not dilated into discs, not markedly out of alignment with rest of digit. Canthus rostralis rounded, snout rounded and projecting well in front of mouth. A scattering of spots dorsally, to some extent aligned in lateral rows; a scattering of spots on upper jaw.

Description. Not normally exceeding 65 mm. Head with flattened, rounded features recalling the head of *Xenopus*. Dorsal pattern a scattering of spots, perhaps also with a tendency to form a broken pair of dorsolateral bands (see Remarks).

Habitat. No information regarding this form is available. In view of the uncertain relationships with *bifasciatus*, exact field data are badly needed.

Remarks. Two NMZL specimens from Kalomo have the non-expanded fingers and rounded snouts which we take to be characteristic of *affinis*, but while in one (No. 6) the markings are composed of spots, to some extent aligned in dorsolateral rows, in the other (No. 2), a 44,5 mm gravid female, the patterning is more of broken dorsolateral bands, not markedly different from *bifasciatus*. Any distinction between *affinis* and *bifasciatus* on markings should evidently be made with caution.

A FMNH Kalabo specimen is referred to *affinis* with some uncertainty. Its condition is poor in two features of diagnostic importance: the snout has been slightly flattened due to postmortem compression, and the digits are desiccated. There is a pair of narrow, broken dorsolateral bands, resembling a specimen from Ombujomatemba (Namibia) that Mertens (1955 fig. 92) placed in *hoeschi*. Poynton (1964*a*) referred Merten's material of *hoeschi* (considered to be a synonym of *affinis*) to *bifasciatus*. Mertens (1971) accepted synonymising *hoeschi* with *affinis*, but argued that his material was *affinis* rather than *bifasciatus*. Three BM males from Ombujomatemba show a range from unbroken to very broken and incomplete dorsolateral bands, and the specimen with the most broken bands has relatively narrow finger tips, which suggests that *affinis* and *bifasciatus* might be found to intergrade in several features. A thorough field study is clearly needed. Boulenger (1901) separated *affinis* from *bifasciatus* on its smaller eye and less dilated digits, but material available to us does not confirm a difference in eye size, even though the *affinis* holotype is at the extreme of overall variation (horizontal diameter of eye 3,3 mm).

Distribution. Known from a few specimens from northern Namibia, western Zambia and southern Shaba (but not the Upemba Park).

Localities. ZAMBIA. ?Kalabo (FMNH), Kalomo (NMZL), Ngoma, Kafue N.P. (NMZB).

Genus *Probreviceps* Parker

Probreviceps Parker, 1931 : 262. Type by original designation: *Breviceps macrodactylus* Nieden.

Metatarsal tubercles well developed but not raised into a digging edge, placed alongside each other and well separated, outer tubercle only slightly smaller than inner. All toes with prominent subarticular tubercles. Upper and lower leg distinctly projecting from body outline when at rest.

Eggs laid in chamber in humus, embryos metamorphosing *in situ*. Restricted to montane forests of Tanzania and Zimbabwe. The Zimbabwe form has shorter limbs than the Tanzanian forms, and in this respect it more closely resembles *Breviceps*. While this feature may be plesiomorphous in respect of *Breviceps*, the ventral positioning of the vent (see Description) is not. The ventral positioning of the vent is also shown in *P. uluguruensis* Loveridge, the species which *rhodesianus* resembles most closely. The vent is not or only slightly deflected in the *macrodactylus* subspecies. The functional anatomy of this feature deserves investigation.

Probreviceps rhodesianus Poynton & Broadley

Probreviceps rhodesianus Poynton & Broadley, 1967: 1. John Meikle Forest Research Station, Stapleford Forest Reserve, Zimbabwe. Holotype in the National Museum, Bulawayo.

Diagnosis. See diagnosis of genus. Tibio-tarsal articulation not reaching elbow, length of tibia less than 0,3 length of body. Tympanum clearly visible.

Description. See Fig. 3. Maximum size of female 49 mm, of male 35 mm. Skin densely granular, without any ridges or larger warts. Upper surface grey (in alcohol) to orange-grey or with orange vermiculations in grey, sometimes with irregular dark stippling on the grey and occasionally with a faintly lighter paravertebral series of patches. Lower surface heavily freckled to marbled, sometimes with orange infusions. Lateral part of head behind eye darkened (but no distinct dark band), often continued as a dark shading on either side of body.

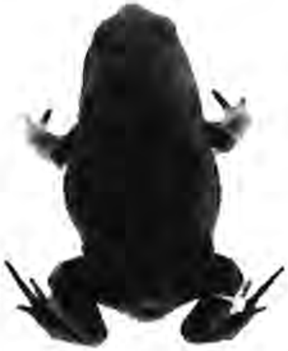


Fig. 3. *Probreviceps rhodesianus*, natural size (NMZB 23294, Gleneagles).

Cloacal opening in both sexes strongly deflected on to the ventral surface, and surrounded by deep skin folds, tending to be less deep in males. Males with looser gular skin than females.

Habitat. Known from montane evergreen forest. It is usually found under rotten logs or beneath drifted dead leaves on the uphill side of logs.

Distribution. Eastern Zimbabwe highlands from Mutare northwards.

Localities. ZIMBABWE. Cecil Kop, Mutare (NMZB), Gleneagles (NMZB), Stapleford (NMZB).

Genus *Breviceps* Merrem

Breviceps Merrem, 1820: 177. Type by monotypy: *Rana gibbosa* Linnaeus.

Inner metatarsal tubercle forming an oblique, spade-like flange across base of foot (at least in forms here considered), outer metatarsal tubercle positioned at its end, tending to continue the flange, varying from being separated from the inner tubercle by a deep cleft to forming a more or less continuous ridge with it. Inner and outer toes minute, without tubercles (in forms here considered). Upper and lower leg tending to be contained in body outline, knee joint not visible when animal is at rest.

Eggs laid in underground chamber, probably in a deep burrow in the savanna-living forms here considered. Embryos metamorphosing *in situ*.

Sylvicolous forms of *Breviceps* on the eastern plateau slopes of South Africa are the longest-toed members of the genus, with a foot that hardly differs from the foot of *Probreviceps* in overall proportions, although the inner metatarsal tubercle is somewhat more ridged. This type of foot differs markedly from the feet of species represented north of the Limpopo, which have greatly reduced inner and outer digits and markedly ridged tubercles. These modifications are evidently an adaptation to living in savanna, where a more efficient burrowing apparatus would be selected for. This trend from forest to savanna living is indicated by the various forms of *Breviceps* in South Africa (Poynton 1964*a*; Poynton & Pritchard 1976), and is taken to its extreme by *poweri* of Zambia. There seems to be an overall trend, therefore, from relatively long-legged, long-toed forms of *Probreviceps* (north of the Limpopo) to the extreme modifications for digging in *B. poweri* (also north of the Limpopo). The intermediate stages are filled in by forms occurring south of the Limpopo, suggesting a southern evolution of *Breviceps* from a *Probreviceps* type of stock. The positioning of the vent on the ventral surface in *Probreviceps*, noted under that genus, excludes it from being considered directly ancestral to *Breviceps*.

Breviceps mossambicus Peters

Breviceps mossambicus Peters, 1854 : 628. Mozambique Island and Sena. Types from Mozambique Island in the Zoologisches Museum, Berlin; Sena material mislaid (G. Peters, in litt.). Peters 1882 : 176, pl. 25, fig. 2, pl. 26, fig. 11, Parker 1930 : 905 & 1934 : 194, Loveridge 1953*a* : 392, Poynton 1964*a* : 84 & 1964*b* : 200 & 1966 : 16 & 1982 : 68, Stewart 1967 : 41, Stevens 1974 : 6.

Breviceps mitchelli Hoffman, 1944 : 182, fig. 10. 'Chitiala', ie. Chitala River, Malaŵi. Holotype in the National Museum, Bloemfontein.

Diagnosis. See under Remarks. Outer finger reaching or nearly reaching distal subarticular tubercle of fourth finger. Inner and outer metatarsal tubercles separated by a cleft. No light paravertebral or dorsolateral patches. Gular region with a single uniformly darkened to (less usually) marbled to freckled patch. Dark infraorbital patch extending to base of arm, in mainland material usually broadly continuous with gular patch.

Description. See under Remarks. Not known to exceed 49 mm.

Habitat. Specimens have most frequently been found under heaps of decomposing vegetation in cultivated areas. There is usually termite activity in such places. Stevens (1974) considered this species an inhabitant of wooded areas in southeastern Malaŵi.

Remarks. Peters (1854) described *mossambicus* from Mozambique Island and Sena. Later, in his *Reise nach Mossambique* (1882), he apparently incidentally described *adspersus* from 'Damaralande (Westafrika), als aus Transvaal, zwischen dem 25. und 26.°S.Br.' (entered as 'Botschabelo' in the Zoologisches Museum catalogue: evidently Botsabelo Mission, 25°42'S : 29°24'E). He did not compare *adspersus* directly with *mossambicus*, but the description indicates differences observed in skin texture (granular dorsally) and in markings (light interocular bar, paravertebral and dorsolateral patches, vertebral line, and a pair of dark gular bands). Poynton (1964*a*) treated *mossambicus* and *adspersus* as distinct species, following Parker (1934), although noting that Zimbabwe and southern Mozambique material probably contained hybrids. Further collecting has produced series from near Beira to Victoria Falls which contain specimens referable to *mossambicus*, to *adspersus*, and to what are clearly hybrids. However, material from northern Mozambique and from the Okavango area is consistent, being either *mossambicus* to the northeast or *adspersus* to the southwest. It therefore seems justifiable still to recognise *mossambicus* and *adspersus* as distinct taxa, despite the occurrence of widespread sympatric hybridisation as defined by Woodruff (1973).

Because of the complex geographical and taxonomic pattern, precision is needed in the use of the names '*mossambicus*', '*adspersus*' and 'hybrids', and the following definitions attempt to provide this precision as far as the complexities allow it. As a basis for *mossambicus*, a series of 21 National Museum topotypes from Mozambique Island is selected. This is the only large series available from northern Mozambique, and in some minor respects which are indicated in the description, this series is not entirely representative of northern Mozambique mainland material. There could be some justification in restricting the type locality of *mossambicus* to the mainland type locality of Sena, near the Zambesi–Shire confluence, but this should await a better understanding of the variation in that area, where gene flow between *adspersus* and *mossambicus* could well occur. Peters' Sena material seems to be lost (G. Peters, pers. comm.), but at the moment the indications are that his clear illustration in *Reise nach Mossambique* (1882) is of a specimen from Mozambique Island.

In the following definitions, which are aimed only at separating *mossambicus* from *adspersus* without separating these from any other taxa, Peters' skin character is omitted because variation in both forms makes this feature valueless.

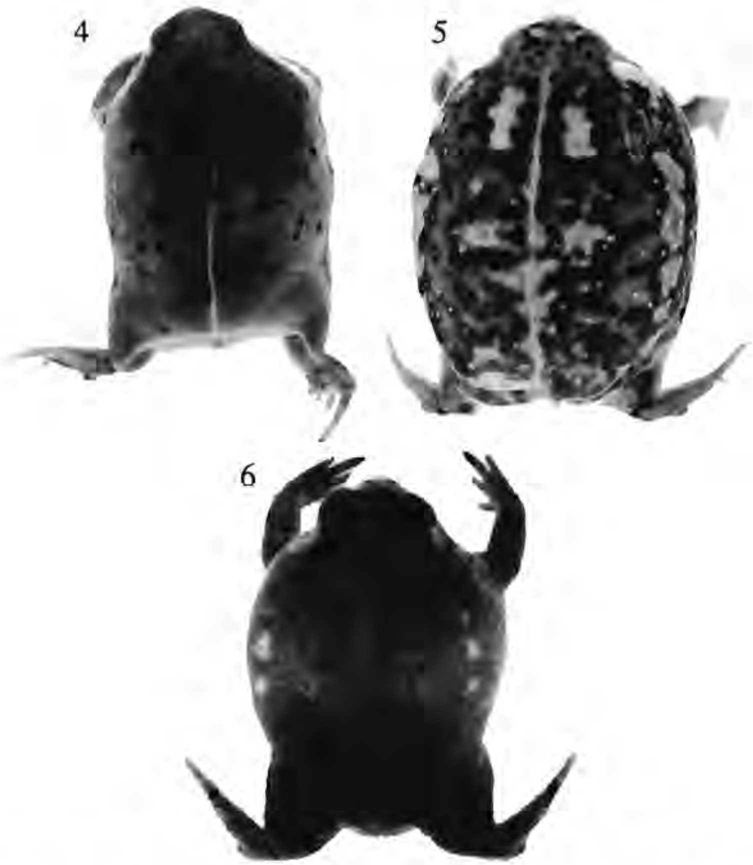
Breviceps mossambicus; Mozambique Island (21 specimens). Fig. 4.

Outer finger reaching distal subarticular tubercle of fourth finger (sometimes falling short in mainland material); tubercles of fourth finger not divided (occasionally divided in mainland material).

Dorsal markings: light anterior interocular bar very faintly shown in some specimens (not shown in mainland material). No light paravertebral or dorsolateral patches. Dark flecks present on most specimens (not such a feature of mainland material). A light vertebral or urostylar line present, very variable in length but not extending onto head; meeting a light line from heel to heel which passes over vent, more or less clearly shown in all but one specimen (mainland material usually without light lines).

Lateral markings: dark oblique band passing from eye to base of arm, continuous with gular patch in some specimens but not in the majority (mainland specimens usually with a broad connection). Fine light lateral speckling in some specimens, which may form a dorsolateral series, but no light patches larger than 0,5 mm.

Ventral markings: gular region with a single uniformly dark to marbled to



Figs 4–6. 4. ***Breviceps mossambicus*** (NMZB 25978, Mozambique Island). 5. *Breviceps adspersus* (NMZB 13010, Kangyane Pan). 6. *Breviceps mossambicus* × *adspersus* (NMZB 4078, Sinoia). Natural size.

freckled patch. Pectoral region immaculate to freckled, abdomen slightly stippled to immaculate (but usually stippled or freckled in mainland material).

Breviceps adspersus; Katima Mulilo, Caprivi (9 specimens). Fig. 5.

Outer finger usually only just passing the proximal subarticular tubercle of fourth finger, but in two specimens almost reaching the distal tubercle. These tubercles are divided to more or less bifid.

Dorsal markings: light interocular bar present, continuous or interrupted medially; series of light paravertebral patches present, the first pair over the scapular region being elongated and symmetrical, the more posterior pairs tending to be asymmetrical and not well defined. Patches have a heavy dark boarder, irregular in width and outline and broken in places, tending to form a wavy lateral border to the posterior set of light patches, and surrounding all but the anterior margin of the scapular pair.

A light vertebral line, commencing on head, present in 8 specimens, in 4 joining a light line from heel to heel passing over vent. A light urostylar patch may or may not be present at intersection of lines, and is also present in the one specimen without any light lines.

Lateral markings: dark oblique band passing from eye to base of arm, not or (in two) only tenuously connected with gular darkening. A lighter area behind the band continues as a series of 3 or 4 light dorsolateral patches, which may merge with each other or be boldly separated by ascending projections of an irregular dark band running beneath the series. This lateral darkening is very variable in its extent and density, but never reaches the prominence shown in Angolan material discussed under *mossambicus*.

Ventral markings: gular region with two more or less uniformly darkened to marbled patches, separated completely or (in one) incompletely by a midventral immaculate strip. Pectoral and abdominal region immaculate except for fine stippling in most specimens—a feature in this series which is not typical of more southern *adspersus*.

Breviceps mossambicus × *adspersus*. Fig. 6.

A series of light dorsolateral patches present but no paravertebral patches. Individuals with this intermediate pattern tend to show a single gular patch, as in *mossambicus*, and a tendency for the outer finger to be relatively long, reaching, as in *mossambicus*, more than half-way between the subarticular tubercles of the third finger (generally less than half-way in *adspersus*).

The need for defining a hybrid phase arises because many localities are represented by only one specimen, which may have ambiguous features yet nevertheless requires some taxonomic placing if only to allow the record to be plotted meaningfully on a distribution map. If a specimen has both paravertebral and dorsolateral patches, it is referred in this paper to *adspersus*; if the specimen has only light dorsolateral patches but no paravertebral patches it is taken as being a hybrid; if there are no light dorsolateral or paravertebral patches, the specimen is referred to *mossambicus*. No account can be taken of gular markings, since they are variable and sometimes indefinite, even though the norm is for *adspersus* outside the hybrid zone to have divided patches and *mossambicus* to have a single patch. Specimens from the hybrid zone with *adspersus* markings tend to have a single patch. The light vertebral and femoral lines also have little diagnostic significance, and are in fact missing in series of *mossambicus*, *adspersus* and hybrids in all of Zimbabwe excepting the south-eastern lowlands.

The hybrid pattern, as here defined according to dorsal and lateral markings, occurs in all large series where both *mossambicus* and *adspersus* patterns are present. So far, there are no indications that this hybrid type has become stabilised anywhere to form a distinctive population. The dorsolateral patches recall the markings of *B. poweri*, but this form can be separated from *mossambicus–adspersus* hybrids by its characteristic urostylar patch, facial markings (see under *poweri*), and anatomically by its very short outer finger and usual fusion of the inner and outer metatarsal tubercles. The relationships between *poweri* and the *mossambicus–adspersus* complex are discussed more fully under that form.

The ratio of *mossambicus*, intermediate and *adspersus* patterns in NMZB single series (collected at the same time) is shown in Table 1.

TABLE 1

Ratio of *Breviceps mossambicus*, intermediate and *adspersus* patterns in single series.

Locality	No. of specimens	*mossambicus* %	intermediate %	*adspersus* %
Muda–Lamego (1934 A4)	22	14	59	27
Xiluvo (1934 A1)	20	20	55	25
Silverstreams (1932 D3)	8	13	25	62
Nyamwanga Farm (1731 B3)	5	40	40	20
Razi (2030 D1)	6	33	17	50
Mvurwi (1730 B2)	16	13	31	56

A minority of *mossambicus* in the two Mozambique series from Muda–Lamego and Xiluvo shows that there is no simple east to west shift in the preponderance of one or other form, although there is a relatively higher representation of the *adspersus* pattern to the west. A recently collected single series of fifteen specimens from Bulawayo all show the *adspersus* pattern, although it is extremely faint in two individuals. A single gular patch is the norm in Bulawayo material, which is not an *adspersus* character, but no completely 'typical' *mossambicus* or *mossambicus* × *adspersus* hybrids have been encountered in Bulawayo collections. This table also shows that there is no decided constancy in the number of intermediates in the different series, although larger numbers would be needed for any definite quantification. Definite quantification is also made difficult by there being a single and gradual range of variation involved: the assigning of specimens to one of the three groups sometimes has to be arbitrary, as when one or more spots are faintly shown on one side but not the other. The above table would be misleading if it gives the impression that *mossambicus*, hybrid and *adspersus* patterns constitute three disjunct groups.

Keith's fine collection, deposited in the AMNH, contains a relatively poorly preserved specimen (A 73842) from Livingstone identified by her as *mossambicus*. It shows no light markings on the dorsal surface, and the outer finger just reaches the distal subarticular tubercle of the fourth finger, both *mossambicus* characters. The feet, although desiccated, are also indicative of *mossambicus*. Keith's collection contains a well-preserved and very typical *poweri* (A 73843) from Livingstone, collected twenty-five days earlier (October 31, 1964). The *mossambicus* record is consonant with the presence of a specimen of *adspersus* from Livingstone in the Livingstone Museum collection (see under *adspersus*). It is possible that *mossambicus* × *adspersus* hybrids may also be found in the area: if so, it is the only known area where these hybrids and the similarly marked *poweri* are sympatric, and clearly a thorough field study is highly desirable.

A 47 mm BM specimen from Mbala (1963.141) has a series of light dorsolateral patches, giving it the appearance of '*mossambicus* × *adspersus* hybrid'. As no typical *adspersus* are known north of Livingstone, it could be suspected that the specimen is a *mossambicus* × *poweri* hybrid, but there is no sign of a urostylar spot, no vertebral or femoral lines, the dark infraorbital band is continuous with the gular patch, the outer finger reaches the distal tubercle of the third finger, and the metatarsal tubercles are well separated—features which show no *poweri* traits at all. A BM juvenile specimen from Mbala is typical *mossambicus*. Development of faint dorsolateral patches is also shown in two MCZ Tanzanian specimens, from Dodoma (9567) and Ikikuyu, Dodoma (10449), but apparently not in a juvenile from Itende, Dodoma (10450). These specimens constitute the northernmost part of the known range of *mossambicus*, and consequently of the genus as a whole, so the dorsolateral patches cannot signify intergradation in these specimens. The same is possibly true for the Mbala specimen, also a marginal record, and it is here referred to *mossambicus*. As noted under *poweri*, *mossambicus* and *poweri* are sympatric in Malaŵi without giving any evidence of hybridisation, but clearly the situation in northern Zambia still needs to be investigated.

Other MCZ and BM material from Tanzania agrees with the material here listed as *mossambicus*. But Angolan material does not, including the specimens listed as *mossambicus* by Parker (1934) and by Monard (1938). Specimens examined from Interior of Benguella, Chiyaka District, R. Donda (?Rio Danda), Guissanga (BM) and Bimbi (MCZ) show facial and gular markings typical of *mossambicus*, but there is a lateral to ventrolateral darkening, varying from being a very clearly demarcated band to being somewhat ragged in outline and with projections extending upwards between the positions of the dorsolateral light spots of *adspersus*. The position of these spots may be further emphasised by a tendency to dark freckling of the dorsal surface, leaving these lateral areas lighter and, in a Bimbi specimen (MCZ 23721), leaving a hint of the *adspersus* paravertebral patches. The outer finger of all these specimens falls just to well short of the distal tubercle of the third finger, another *adspersus* rather than *mossambicus* feature. A tendency towards not dissimilar lateral banding and dorsal freckling is shown in specimens from upland areas of eastern Zimbabwe, discussed under *adspersus*. A case for nomenclatural recognition of the Angola material seems strong—stronger than for the eastern Zimbabwe material, and a wider survey of Angolan *Breviceps* is badly needed; in the mean time the Angolan material is excluded from *mossambicus* Peters in this study. Poynton (1982) has compared the east–west differentiation of *mossambicus s.l.* with the differentiation of *Mabuya striata* into eastern *s. striata* and western *s. wahlbergii*, discussed by Broadley (1977). In the *Breviceps* case, the eastern and western forms are widely separated geographically by *adspersus* and *poweri*, and the western form appears to have hybridised with *adspersus* (see under *adspersus*), as has eastern *mossambicus* with *adspersus*. An apparently similar situation is described amongst the parrot superspecies *Poicephalus meyeri* by Snow (1981).

Distribution. 'Pure' *mossambicus* occurs in the southern half of Tanzania (not Zanzibar), northern Zambia, Shaba (but not Upemba Park), Malaŵi and northern Mozambique. Present as one end of range of variation through to *adspersus* in southern Mozambique, Zimbabwe, probably southern Zambia, eastern Botswana, eastern Transvaal, northern Natal.

Localities. See Fig. 1 in Poynton (1982). An asterisk following a locality indicates that the 'hybrid' pattern has been taken there, but this does not necessarily imply that specimens with the *mossambicus* pattern have not also been taken there.

BOTSWANA. Francistown (NMZB). ZAMBIA. Fwambo (BM), Livingstone (AMNH), Mweru Wantipa (BM). MALAŴI. Blantyre (AJL), Chisambo (NMZB), Chitala (NMB), Chitipa (BM), Likabula–Chambe (NMZB), Lilongwe (NMZB), Lujeri (MCZ, NMZB), Lujeri–Madzeka* (NMZB), Mangochi (BM), Masaka Mountain (BM), Misuku Hills (East) (NMZB), Misuku Mountains (MCZ), Mtimbuka (NMZB), Mzuzu (MRAC), Thyolo Mountain (MCZ), Thyolo Mountain* (NMZB), Zomba (BM, JV, NMZB). Blantyre; Kasungu (Loveridge 1953a). MOZAMBIQUE. Alves de Lima* (NMZB), Erego (NMZB), Estatuane* (NMZB), Garuso* (NMZB), Gumba* (NMZB), Inchope* (NM, NMZB), Macia (SAM), Martin's Falls* (NMZB), Masieni (TM), Meponduine* (NMZB), Mitucué Mountain (NMZB), Moamba (TM), Morrumbala Mountain (NMZB), Mozambique Island (NMZB, ZMB), Muda-Lamego* (NMZB), Ponte do Calichane (NM), Vanduzi* (NMZB), Vila Junqueiro (NMZB), Xiluvo* (NMZB). Sena (Peters, 1854). ZIMBABWE. Bembezi* (NMZB), Bulawayo* (NM, NMZB, TM), Chimanimani Mountains* (NMZB), Chinhoyi* (NMZB), Chiredzi* (NMZB), Dunblane* (NMZB), Empress Mine (NMZB), Fern Valley* (NMZB), Harare (NMZB), Haroni Forest (NMZB), Hippo Valley* (NMZB), Jersey Estate (NMZB), Kilimani* (NMZB), Mabalauta F.S.* (NMZB), Makurupini Valley* (NMZB), Mapoff Estate* (NMZB), Marondera (NMZB), Mazoe (BM), Mount Selinda* (NMZB), Musirizwi River (NMZB), Mutare* (NMZB), Mvurwi* (NMZB), Ntabambomvu Hills (NMZB), Nyamwanga Farm* (NMZB), Penhalonga* (NMZB), Rupisi* (NMZB), Selborne* (NMZB), Silverstreams* (NMZB), Solusi* (NMZB), Tokwe River* (NMZB), Toronto (NMZB), Victoria Falls (NMZB).

Breviceps adspersus Peters

Breviceps adspersus Peters, 1882 : 177. Damaraland and Transvaal (see Remarks under *mossambicus*). Types in the Zoologisches Museum, Berlin. Parker 1934 : 193; FitzSimons 1939 : 44 & 1958 : 214, Poynton 1982 : 68.
Breviceps mossambicus (not of Peters); FitzSimons 1939 : 45.
Breviceps adspersus adspersus Peters; Poynton 1964*a* : 79.
? *Breviceps mossambicus adspersus* Peters; Broadley 1971 : 111.

Diagnosis. See Remarks under *mossambicus*. Outer finger usually falling far short of distal tubercle of fourth finger. Inner and outer metatarsal tubercles separated by a cleft. A series of light paravertebral and dorsolateral patches present. Gular region with a pair of marbled to freckled patches, separated by an immaculate midventral band. Dark infraorbital patch tending or actually extending to base of arm.

Description. See Remarks under *mossambicus*. Not known to exceed 59 mm.

Habitat. This savanna species appears above ground only during the rains, when specimens may often be found feeding on alate termites in the vicinity of a termitarium. They may be found sheltering under rocks or logs.

Remarks. Only two specimens from Zambia west of the Zambesi have so far been collected (FMNH 134566 from Lukona Mission and FMNH 142947 from Kalabo). In the Lukona specimen, the gular patches are well separated by a light medium band, typical of *adspersus*, but light paravertebral and dorsolateral patches are lacking, although the dark border normally outlining the paravertebral patches is present. There is fairly heavy dorsolateral dark speckling, and heavy lateral dark marbling with little indication of its bordering the position of the light dorsolateral patches of *adspersus*. These dark markings strongly recall the markings of Angolan material formerly referred to *mossambicus*, but which (as discussed under *mossambicus*) evidently belong to a different form, not yet described. This specimen appears to be a hybrid between the Angolan form and *adspersus*. The juvenile Kalabo specimen also has well-separated gular patches, but no dorsal light patches, and dark markings similar to the Lukona specimen are present although not so well developed. It is also presumed to be a hybrid between Angolan '*mossambicus*' and *adspersus*. These Zambian specimens differ from Angolan material mainly in their clearly divided gular patches, which are not connected to the lateral facial markings: in the Angolan material the patch is single and broadly connected to the lateral darkening, typical of East African *mossambicus*.

A single Livingstone Museum specimen from Dambwa North cemetery, Livingstone (1078), is typical *adspersus*, with a pair of light scapular patches, a well divided gular patch, relatively long fourth finger, and metatarsal tubercles demarcated by a clean cleft. As noted under *mossambicus*, *mossambicus* × *adspersus* hybrids should be looked for in the Livingstone area, where *poweri* also occurs.

Specimens from mainly upland areas of eastern Zimbabwe also show a loss of the light *adspersus* patches while still retaining the dark edging, which may become emphasised laterally. Specimens showing this pattern have been collected from Bundi Valley (NMZB 3501–02, 2478), Butler North (NMZB 16600), Chimanimani Mts (NM 1935–40, NMZB 33454), Engwa (NMZB 16643), Inyangani Mt. (NMZB 29300), Kilimani (NMZB 17524), Martin's Falls (NMZB 3482), Mutare (NMZB 27086), Nuza, Stapleford F.R. (NMZB 3352–58), Rupisi (NMZB 13423), Selborne (NMZB 12368), Sheba Estate and The Corner (NMZB 29339). They are here listed as *adspersus, mossambicus* or hybrids, with which they seem almost inextricably mixed, but more field work may well show the material to represent yet another undescribed form.

All the Inhaca Island material is here listed as *adspersus*, but variation shown by these specimens is far greater than in 'typical' western material (as it is in all southern Mozambique material), so no clear zoogeographical conclusions are apparent.

Relationships with *mossambicus* and *poweri* are discussed under those forms.

Distribution. 'Pure' *adspersus* occurs in Natal (except the Mozambique Plain), Transvaal (except the eastern edge), Botswana, Namibia and at least the Livingstone area of Zambia. Present as one end of range of variation through to *mossambicus*, in southern Mozambique, Zimbabwe, eastern Botswana, eastern Transvaal, northern Natal. The presence of *mossambicus–adspersus* hybrids in Malaŵi (see under *mossambicus*) suggests at least a former occurrence of the *adspersus* pattern there. Apparently hybridising with 'Angolan *mossambicus*' west of the Zambezi in Zambia.

Localities. See Fig. 1 in Poynton (1982). Localities of series with *adspersus* × *mossambicus* hybrids are not listed here, even though individuals with the *adspersus* pattern may be present. These localities are marked with an asterisk under *mossambicus*. Apparent *adspersus* × 'Angolan *mossambicus*' hybrids are marked with an asterisk in this list.

BOTSWANA. Butsingwango River (TM), 64 km SW Ghanzi (NMZB), Gomodimo Pan (TM), Kangyane Pan (NMZB), Kaotwe Pan (TM), 65 km NE Lephepe (NMZB), Mabeleapodi (TM), 22 km N Mabuasehubi Pan (NMZB), Maun (NMZB), Metsemotlhaba River (TM), Motsobonye Pan (NMZB), 120 km W Nata (NMZB), Ngamiland District (TM), Nokaneng (TM), Shakawe (TM), Shorobe (NMZB), Tamafupa (NMZB), 16 km N Tobane (NMZB), Vloorskop (NMZB), 24 km E Xade Pan (NMZB). CAPRIVI. Katima Mulilo (NMZB, TM). ZAMBIA. Kalabo* (FMNH), Livingstone (NMZL), Lukona* (FMNH). MOZAMBIQUE. Alves de Lima (NMZB), Amamba (NMZB), Chimonzo (TM), Inhaca Island (NMZB, TM), Malanguene (NMZB), Maputo (BM, TM), Martin's Falls (NMZB), Massinga (TM), Moamba (TM), Pambarra (NMZB), Ponta de Ouro (TM), 3 km W Zinave (NMZB), Zivanga (NMZB). ZIMBABWE. Antelope (NM), Birchenough Bridge (TM), Buffalo Range (NMZB), Bulawayo (NMZB), Bundi Valley (NMZB), Butler North (NMZB), Chilimanzi (NMZB), Chimanimani Mts (NM, NMZB), Chinhoyi (NMZB), Chipinda Pools (NMZB), Elim Mission (NMZB), Engwa (NMZB), Fishan, Gonarezhou (NMZB), Gokwe (NM, TM), Gwamayaya River (BM), Haroni Forest (NMZB), Highlands, Harare (NMZB), Inyanga (TM), Inyangani Mt. (NMZB), Irisvale (NMZB), Juliasdale (NMZB), 10 & 16 km SE Kapami (NMZB), Kilimani (NMZB), Lupane (NMZB), Magune Pan (NMZB), Mahenya (NMZB), Majinji Pan (NMZB), Malapati Drift (NMZB), Maleme Dam (NMZB), Malugwe Pan (NMZB), Mare Dam (NMZB), Monte Cassino (AM, NMZB), Mutare (NMZB), Mutoko (AM), Noro Dam, Darwin (NMZB), Nyamugwe Pan, Gonarezhou (NMZB), Nyamwanga farm (NMZB), Penhalonga (NMZB), Pungwe Gorge, Inyanga (NMZB), Ranelia (NMZB), Razi (NMZB), Rupisi (NMZB), Rusape (AM), Selborne (NMZB), Shashi–Shashani Confluence (NMZB), Sheba Estate (NMZB), Stapleford (NMZB), The Corner (NMZB), Udu Dam, Inyanga N.P. (NMZB), Van Niekerk Ruins (NMZB), Victoria Falls (NMZB), Vumba Mountain (NMZB), Zimunya (NMZB).

Breviceps poweri Parker

Breviceps poweri Parker, 1934 : 195. Broken Hill (ie. Kabwe), Zambia. Holotype in the British Museum (N.H.), London. Poynton 1964*a* : 83 & 1964*b* : 199 & 1982 : 68, Stewart 1967 : 41, Broadley 1971 : 111, Stevens 1974 : 6.

Breviceps mossambicus (not of Peters); Parker 1930 : 905.

Diagnosis. Outer finger not reaching to barely passing proximal subarticular tubercle of fourth finger. Inner and outer metatarsal tubercles fused to form a single continuous flange in most specimens, but more or less separated by a cleft in specimens from various parts of the range. A series of 3 to 6 dorsolateral patches present, which may be fused as an irregular light dorsolateral band; a light patch over urostylar tip, at intersection of a light heel-to-heel line and vertebral line which are usually present (Fig. 7). Gular region with a single uniformly darkened to marbled patch, which is separated from the dark infraorbital patch by a usually broad and uninterrupted light band from upper jaw to arm.

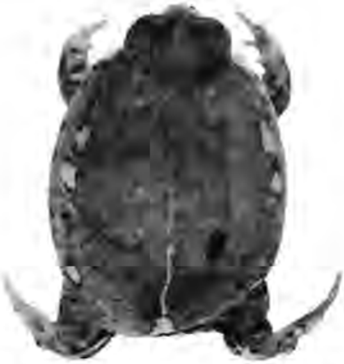


Fig. 7. *Breviceps poweri* (NMZB-VW 857, Chipata), natural size.

Description. See Remarks under *mossambicus* and below. Not known to exceed 50 mm.

Habitat. In southeastern Malaŵi, Stevens (1974) found this species to be common in dry savannas of the Shire Valley and Palombe–Tuchila–Chilwa Plain.

Remarks. On the basis of its dorsal patterning, *poweri* could be viewed as a stabilised population of *mossambicus–adspersus* hybrids (see under *mossambicus*), a possibility not discussed by Parker (1934) because at that time hybridisation was not suspected. However, facial markings and the conspicuous spot above the vent in *poweri* is not a feature of *mossambicus, adspersus* or their hybrids, and there are morphological differences: the outer finger and toe are shorter than in either *mossambicus* or *adspersus*, and the inner and outer metatarsal tubercles are more closely aligned and usually fused to form a single digging flange, while in the other two forms they are separated by a cleft, especially in young animals, and are not lined up as a single ridge.

These morphological features of *poweri* may be considered apomorphous, showing the most extreme condition of digital reduction and tubercle development in the genus, a trend associated with more effective burrowing in a savanna environment (Poynton & Pritchard 1976). The outer finger in *poweri* varies from not to barely passing the proximal tubercle of the third finger, and the outer toe, already a very short stub in *mossambicus* and *adspersus*, is, to quote Parker (1934), 'a mere tubercle' in *poweri*. These apomorphous features of *poweri* do not allow it simply to be regarded as a uniformly marked Zambian population of *mossambicus* × *adspersus* hybrids.

Variation in Botswana and western Zimbabwe *adspersus* tends towards the *poweri* characteristics of a short outer finger and the union of metatarsal tubercles to form a single digging flange; indeed, variation in these features in both *adspersus* and *poweri* makes a clean separation between the two forms on morphological grounds impossible. In addition some *adspersus* from Botswana and western Zimbabwe have the light urostylar patch of *poweri*, and several specimens of *poweri* show a trace of the interocular bar of *adspersus* and, less commonly, traces of the more anterior paravertebral patches. The gular markings in *poweri*, on the other hand, are a single patch as in *mossambicus* and *mossambicus* × *adspersus* hybrids.

The limited amount of material available from the Livingstone area indicates that *poweri* is sympatric with *mossambicus* and *adspersus* without hybridising (p. 524). A careful study of this area is needed to confirm this impression. The BM has one specimen each of *poweri* and *mossambicus* collected by Vesey FitzGerald from Mweru Wantipa. In Malaŵi, *mossambicus* and *poweri* have been collected without any indication of hybridisation occurring between them. Two specimens of *mossambicus* and three of *poweri* have been recovered by one of us (D. G. B.) from a single trench at Lilongwe, and are easily separated on finger and toe length, condition of metatarsal tubercles and markings. There are no indications of ecological differences, but calls have not yet been recorded, and nothing has been observed regarding mating behaviour. Stevens (1974) has reported sympatry at Mikolongwe.

Laurent (1956) stated that *poweri* has a darkened tip to the snout, while *mossambicus* does not. A well-marked 'moustache' between nostrils and lip is a characteristic feature of *poweri*, which *mossambicus* usually lacks, but some series of *mossambicus* show a wide range of variation, including heavily darkened snouts, as in MCZ 25505–9 from Mikindani, southeast Tanzania, a series which is well removed geographically from any possible *poweri* influence. This feature therefore cannot be used in separating material into the two forms. Snout darkening is present also in *adspersus*. The darkened snout tip is more conspicuous in *poweri* because of the lack of pigmentation elsewhere over the upper jaw, resulting in a characteristic light band running from upper jaw to forearm. This light band is a feature of *poweri* not present in *mossambicus, adspersus* or their hybrids, since in these latter forms the dark infraorbital band runs obliquely downwards to the base of the arm, or is continued to the arm by dark patches, thereby interrupting what would be the upper jaw-to-arm light band of *poweri*. These two different facial patterns contrast quite markedly, as shown in Fig. 8, and may be of importance in species recognition at the beginning of mating.

Two BM specimens collected by Cott from Charre, Mozambique, show all the features of *poweri*. They were identified as *mossambicus* by Parker (1930) but were not listed at all in his 1934 monograph.

Distribution. Zambia, southeastern Shaba (not the Upemba Park), Malaŵi, inland northern Mozambique.

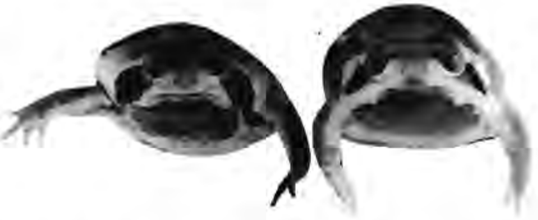


Fig. 8. *Breviceps mossambicus* (left) and *B. poweri* (right), both from Lilongwe (NMZB 25055 & 25058). Natural size.

Localities. ZAMBIA. Chikowa (NMZB), Chipangali (NMZB), Chipata (NMZB), Chunga (NMZB), Kabwe (BM), Kafue N.P. (NMZB), Kalabo (FMNH), Kalichero (NMZB), Kasempa (AMNH), Kasusu (NMZB), Katete (NMZB, TM), Livingstone (AMNH), Luembwe (NMZB), Lusaka (ANMH), 90 km E Lusaka (BM), Msandile (NMZB), Mkanda area (NMZB), Mporokoso (PEM), Mumbwa (AMNH), Muzuma River, Mweru Wantipa (BM), Ndola (NMZB), Nkana, Kitwe (MM), Petauke (BM), Sayiri Court (NMZB), Zimba (BM), Zongue (= Mzuma) River, L. Kariba (BM). MALAŴI. Kasungu (MCZ), Lilongwe (NMZB), Mpatamanga Gorge (NMZB). Mikolongwe; Palombe–Tuchila–Chilwa Plain; Shire Valley (Stevens 1974). MOZAMBIQUE. Charre (BM).

Family HEMISIDAE

A monogeneric African family with no clear relationships.

Genus *Hemisus* Günther

Hemisus Günther, 1858 : 47. Type by monotypy: *Engystoma guttatum* Rapp.

Shovel-nosed Frogs. Pupil vertical. Upper jaw without teeth. Omosternum ossified, not forked. Procoracoid-clavicular (or anterior coracoid) bar massively developed, coracoids (or posterior coracoid bars) rodlike and projecting obliquely backwards. Toes without webbing. Head relatively small and sharply pointed, tip of snout hardened and used for digging.

Widespread in Subsaharan Africa, excluding Namibia and the western, central and southern parts of South Africa. Eggs appear to be laid in an underground chamber near water and tadpoles given access to water by the female (Wager 1965).

Günther's description of the genus can leave no doubt that the word *Hemisus* is neuter, its ending being derived from *ous*, the Greek for ear. Specific names should therefore end with *-um*, not, as is commonly done (eg. Laurent 1972), with *-us*.

In the interests of nomenclatural stability, we follow Laurent's (1972) tentative taxonomic proposals for this genus, but, as will be seen from the discussions, a fully workable taxonomy still has to be devised. Laurent's usage of the subspecific category is also largely followed in the interests of stability, though not with any conviction that such usage is appropriate in this complex and still poorly known group.

Key to the Zambesiaca species and subspecies of *Hemisus*

1 Mature males not normally exceeding 30 mm, nor females 38 mm .... **marmoratum marmoratum**
— Mature males normally exceeding 30 mm, females 38 mm 2
2 A light vertebral band (sometimes containing a light line) present, bordered on either side by a more or less regular dark band .... **wittei**
— Light vertebral line, if present, not contained in a light vertebral band with continuous dark bordering 3
3 Fifth toe relatively short, less than 75% length of inner metatarsal tubercle .... **guineensis broadleyi**
— Fifth toe long, more than 75% length of inner metatarsal tubercle .... **guineensis microps**

Hemisus marmoratum marmoratum (Peters)

Engystoma marmoratum Peters, 1854: 628. Cabaceira, Mozambique. Types in the Zoologisches Museum, Berlin.
Hemisus marmoratum (Peters); Peters 1882: 173, pl. 25, fig. 1, 1a, pl. 26, fig. 10, Boulenger (part) 1907*a*: 480, Hewitt 1913: 480, Parker 1930: 905, Poynton (part) 1964*a*: 166 & 1964*b*: 214 & 1966: 24 & 1982: 69, Stewart 1967: 144, Broadley 1971: 119, Stevens 1974: 9.
Hemisus sudanensis (not Steindachner); Pfeffer 1893: 103.
Hemisus sudanense (not Steindachner); Bocage 1896: 102, Werner 1907: 1906.
Hemisus marmoratum marmoratum (Peters); FitzSimons 1935: 394, Loveridge 1953*a*: 392.
Hemisus marmoratus marmoratus (Peters); Laurent 1972: 29.
Hemisus marmoratus subsp; Laurent 1972: 33.

Diagnosis and description. See Figs 9–10. Males not normally exceeding 30 mm, females 38 mm. Free part of fifth toe 77–160% of inner metatarsal tubercle, width upper eyelid 40–90% of free part of fifth toe, width upper eyelid 30–50% of interorbital distance, internarial distance 55–80% of eye–nostril distance, eye–nostril distance 70–100% of length upper eyelid. Dorsal ground colour brown to olive to yellow-brown, with darker vermiculation, marbling or blotching if background not completely dark. Difficulties in diagnosis are discussed under Remarks below and under *guineensis broadleyi*.

Habitat. Frequently found buried in damp sand beneath dry river beds in lowveld areas, this species tends to keep close to permanent or temporary pans or watercourses. It is found above ground only in wet weather.

Remarks. Laurent (1972) has suggested that Botswana and western Transvaal material of *marmoratum* belongs to a separate subspecies, the characteristics being a 'uniform sallow coloration with lighter head', also 'the inner metatarsal tubercle stronger and fifth toe shorter', and 'the first finger is also somewhat longer, especially in the females'. Five of the twelve specimens that he examined are in the Transvaal Museum. Of these, the specimen that best fits his description is TM 13120 from Gravelotte, but Gravelotte is in the *eastern* Transvaal lowlands. The two Bushman Mine (Botswana) specimens (14815–16) do not fit his colour description, one being uniformly dark, the other dark and indistinctly mottled. TM 14817, cited by Laurent as also from Bushman Mine, carries the label

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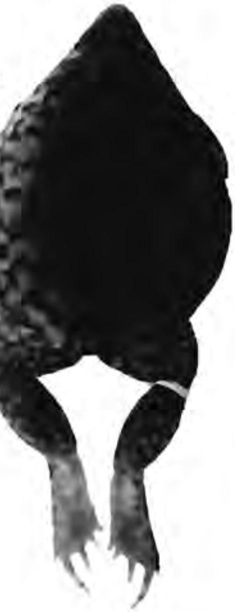

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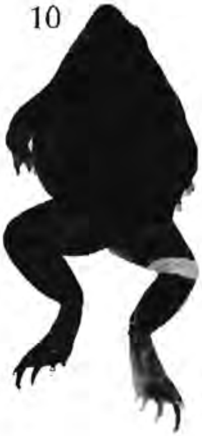

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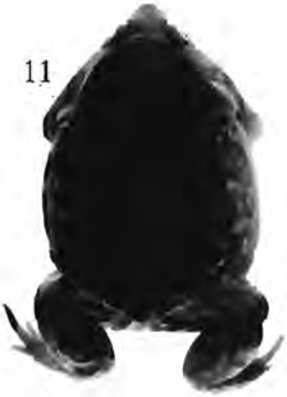

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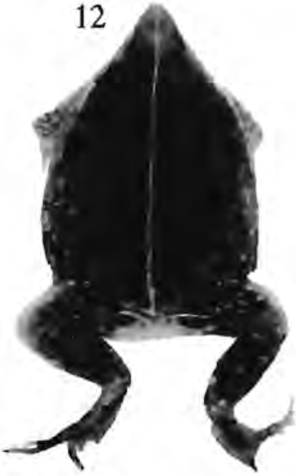

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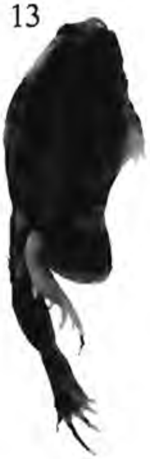

Figs 9–13. 9–10. *Hemisus marmoratum*. 9. female (NMZL 157) and 10. male (158, Livingstone). 11. *Hemisus guineensis broadleyi* (NMZB 13101, Muda-Lamego). 12. *Hemisus guineensis microps* (NMZB 31795, Four Rivers Camp). 13. *Hemisus wittei* (BM 1976. 340, Mweru Wantipa). Natural size.

'Metsimaklaba', 4° further south. It agrees with Laurent's colour description. The Bridgewater specimen, TM 12959, fits his description of 'sallow coloration' apparently only because it is faded, the gular region of this male also being 'sallow'.

National Museum material from Botswana and Caprivi gives no support to Laurent's suggestion of a 'western' subspecies. These 14 specimens have a typical marbled pattern, becoming indistinct in four because of general darkening. Variation in the fifth toe/metatarsal tubercle ratio is not different from variation in Zimbabwe, the fifth toe being subequal to slightly longer than the tubercle. In the four females in the collection, the first finger is marginally longer than the second, but falls within the range of variation of Zimbabwe material, the first finger being subequal to noticeably longer than the second in Zimbabwe females.

Difficulties in assigning some specimens either to *marmoratum* or to *guineensis broadleyi* are discussed under *g. broadleyi* and by Poynton (1982). The complex situation suggests either that the taxa proposed by Laurent (1972) do not conform with natural grouping, or else that hybridisation between the taxa must be allowed for.

Distribution. Northern Zululand, eastern and western Transvaal, eastern and northern Botswana, Zimbabwe and Mozambique northwards to southern Somalia (Lanza 1981).

Localities. See Poynton 1982, fig 2. BOTSWANA. Bushman Mine (TM), Francistown (AM), Kasane (NMZB), Khwai River (NMZB), Magogaphate Game Camp (NMZB), Metsemotlhaba River (TM), Tshesebe (TM). CAPRIVI. Katima Mulilo (TM), 15 km SW Katima Mulilo (NMZB), Muyako (TM). ZAMBIA. Chakwenga River (NMZB), Chikwa (NMZB), Chimene Stream (BM), Chipangali (NMZB), Chipata (NMZB), Chunga (NMZB), Kalikali (NMZB), Katete/ Lupande (NMZB), Kazungula (NMZB), Kondolilo Falls (NMZB), Livingstone (AMNH, NMZL), Luembwe (NMZB), 8 km E Lusaka (BM), Lusangazi (NMZB), Mbala (PEM), Mfuwe (NMZB), Mkanda (NMZB), Monze (NMZL), Mumbwa (AMNH), Ngoma (NMZB), Sesheke (NMZB). MALAŴI. Blantyre (AJL), Chipoka (AJL), Chowe (MCZ), Lake Chiwondo (NMZB), Lilongwe (NMZB), Mtimbuka (MCZ), Mulosa (JV), Zomba (BM), Zomba Mountain (BM). MOZAMBIQUE. Beira (BM), Cabaceira (ZMB), Charre (BM), Dondo (NMZB), 16 km NE Dondo (NMZB), Fambani River (BM), Lamego (NMZB), Magasso (NMZB), Magude (TM), Manga (NMZB), 8 km E of Mapulanguene (TM), Massangena (NMZB), Muda/Lamego (NMZB), Nabaunama Dam (NMZB), Nova Sofala (NMZB), Tete (NM), Vila de Manica (NMZB), Xiluvo (NMZB), Zinave (NMZB). Quelimane (Pfeffer 1892). ZIMBABWE. Atlantica (AJL), Bembezi (NMZB), Buffalo Bend Pan (NMZB), Bulawayo (NMZB), 11 km S of Bulawayo (NMZB), Charama Plateau (NMZB), Charara-Kariba confluence (NMZB), Chete Gorge (NMZB), Chinyamanda (NMZB), Chipinda Pools (NMZB), Chizarira Game Reserve (NMZB), Deteema (NMZB), Esigodini (NMZB), Gairezi Bridge (NMZB), Gokwe (TM), Harare (AM, NMZB), 16 km W Harare (NMZB), Hunyani (NMZB), Jalopi Bridge (NMZB), Kotwa (NMZB), Kutama Mission (AJL), Kwekwe (NMZB), Lundi River Bridge (NM), Lusulu (NMZB), Mabalauta F.S. (NMZB), Machinawa Pan (NMZB), Mahenya

(NMZB), Majinji Pan (NMZB), Malikango (NMZB), Malugwe Pan (NMZB), Marhumbini (NMZB), Matopos (NMZB), Matowa (NMZB), Matusadona N.P. (NMZB), Mgwalaati Farm (AJL), Mhangura (NMZB), Msoro (NMZB), Musami (AM), Mutare (NM, NMZB), Mutoko (AM), 55 km NE Mutoko (NMZB), Mvuri (NMZB), Mwenezi (NMZB), Nyadekese Dam (NMZB), Nyakasikana (NMZB), Nyamandhlovu (NMZB), 5 km W Nyampanda (NMZB), Nyamuweni Pan (NMZB), Nyanyana–Kariba Confluence (AJL), Old Umtali (NMZB), Ranelia (NMZB), Ruda River (NMZB), Rukomeshe Research Station (NMZB), Rukute Farm (NMZB), Sengwa Gorge (NMZB), Stapleford (NMZB), Teaklands (NMZB), Umfuli River (BM), Victoria Falls (NMZB), 24 km W Victoria Falls (NMZB), Warren Hills (AJL), Zambezi–Chewore Confluence (NMZB).

Hemisus guineensis broadleyi Laurent

Hemisus marmoratum (not Peters); Boulenger (part) 1907*a*: 480, Poynton (part) 1964*a*: 166.
Hemisus guineensis broadleyi Laurent, 1972: 57. Fig. 28. 51 km NE Mutoko, Zimbabwe. Holotype in the National Museum, Bulawayo. Poynton 1982: 69.

Diagnosis and Description. See Fig. 11. Males reaching 36 mm, females 46 mm. Free part of fifth toe 45–77 % of inner metatarsal tubercle, width upper eyelid more than 60 % of free part of fifth toe, width upper eyelid 33–45 % of interorbital distance, internarial distance 50–85 % of eye–nostril distance, eye–nostril distance 80–107 % of length of upper eyelid. Dorsal coloration generally uniform dark grey to brown, sometimes with a few light dots and/or (especially in Mozambique) a light vertebral line. Differing from *guineensis microps* in having shorter toes and larger eyes, width of upper eyelid being more than 60 % length of fifth toe, although intergrading appears to occur (see Remarks under *g. microps*). Separation from *marmoratum* seems impossible in some cases, as discussed under Remarks below.

Habitat. It is not yet known whether *g. broadleyi* differs from *marmoratum* ecologically. In Hwange National Park, a specimen was found at a depth of 30 cm at the base of a dead tree.

Remarks. Most available material can be separated into *g. broadleyi* and *marmoratum* without much difficulty according to Laurent's criteria. Difficulties become greater with other specimens, to the point where separation becomes impossible. Three problematic cases may be cited, in increasing order of difficulty, to illustrate what is involved.

A 41 mm NMZB female from Thorn Park, Harare, has a clear *marmoratum* patterning, but in addition there is a light vertebral line. These features of size and markings taken together allow no definite diagnosis. However, the metatarsal tubercle is relatively short, being subequal to the length of the fifth toe, and so on balance the specimen could be referred to *marmoratum*. A 20 mm juvenile collected earlier from the same locality has been identified as *marmoratum* by Laurent. In this specimen the metatarsal tubercle is also subequal to the length of the fifth toe, and the markings are typical of *marmoratum*.

A more difficult situation is presented by two NMZB specimens from Empress Mine, Kadoma. A 32 mm female has a marbled pattern, a faint vertebral line, and large metatarsal tubercles, well within the range of *g. broadleyi*, the fifth toe being

72% of the tubercle. It is unclear which species this specimen should be referred to, and no decisive guidance is provided by one other specimen collected with it, a 16 mm juvenile with marbled patterning, a light line over the urostyle, and subequal metatarsal tubercle and fifth toe.

A TM male from Chigubo, southern Mozambique, has a snout–vent length of 33 mm, marbled dorsal markings (although contrast is not great due to a fairly dark ground colour) and a light middorsal line over the urostylar area. These features taken together give no clear identification, but in view of its size (see Laurent 1972, fig. 5), could suggest a small specimen of *g. broadleyi*. But the outer toe is 105% of the metatarsal tubercle, which falls well within Laurent's range for *marmoratum*. A TM 35 mm female collected with it has only barely discernible dorsal mottling, the back being virtually uniform dark as in *broadleyi*, but the outer toe is 96% of the tubercle, again well within the stated *marmoratum* range.

It appears from such cases as these that Laurent (1972) underestimated the complex variation in southern African *Hemisus* when he rejected Poynton's contention (1964*a*) that there was intergradation in the material then grouped together as *marmoratum*. It is possible that the situation is of the same order of complexity as that shown in the *Breviceps mossambicus* group (Poynton 1982). If this is so, then, as in the *B. mossambicus* complex, the imposition of a fully workable taxonomic scheme will not be possible, but clearly more and bigger series of specimens are needed, together with critical field data, before much more can be said.

A NMZB specimen from Maleme Dam, Matopos, here referred with uncertainty to *broadleyi*, could be a *microps–broadleyi* hybrid in respect of its relatively long fifth toe, the eyelid/toe percentage being 44, compared with 27–37% in *microps* and + 54% in *broadleyi*. This specimen has uniform dorsal coloration, typical of Zimbabwe *broadleyi*.

Distribution. Zambia, Zimbabwe, Mozambique, northern Transvaal (TM 39967, Rochdale Farm 2229 D3).

Localities. See Poynton 1982, fig. 3. Localities presenting apparent *marmoratum–guineensis* hybrids are marked with an asterisk. ZAMBIA. Kalikali (NMZB). MOZAMBIQUE. Beira (BM), Canganetole (NMZB), Chigubo* (TM), 16 km NE Dondo (NMZB), Luala River Bridge (NMZB), Muda–Lamego (NMZB). ZIMBABWE. Bulawayo (SAM), 15 km S Bulawayo (NMZB), Chilonga (NMZB), Chizarira Game Reserve (NMZB), Empress Mine* (NMZB), Esigodini (NMZB), Kampoti Rapids (NMZB), Kotwa (NMZB), Maleme Dam (NMZB), Msoro (NMZB), 51 km NE Mutoko (NMZB), Nyamandhlovu Pan (NMZB), 5 km W Nyampanda (NMZB), Saffron Walden (NMZB), Shapi Pan and Shumba Camp, Hwange N.P. (NMZB), Thorn Park* (NMZB).

Hemisus guineensis microps Laurent

Hemisus guineensis microps Laurent, 1972: 55, fig. 27. Kidada, Lower Zaïre. Holotype in the Musée Royal de l'Afrique Centrale, Tervuren.

Diagnosis and Description. See Fig. 12. Males reaching 36 mm, females 52 mm. Free part of fifth toe 75–130% of inner metatarsal tubercle, width upper eyelid < 60% of free part of fifth toe, width upper eyelid 20–35% of interorbital distance, internarial distance 45–66% of eye–nostril distance, eye–nostril distance 95–135% of length of upper eyelid. Dorsal coloration with faintly discernable mottling to well-marked dark and light, obliquely set banding; a sprinkling of minute white dots or light flecks usually present, and a light vertebral line. See also under Remarks.

Habitat. The NMZB specimen from Ikelenge District was collected in savanna woodland near the Zambezi rapids (C. A. Green, field notes). The Four Rivers Camp series from northern Botswana was collected in open grassland after a fall of rain. The Xaxaba female was found in a depression under a *Hyphaene* palm log.

Remarks. Material listed here constitutes a large southward extension of the range of *g. microps* given by Laurent (1972), but it appears to fit *microps* better than any other currently described taxon. The southernmost locality given by Laurent is Lealui in Zambia (1531 A1). Five NMZB specimens (UM 31791–95) from Four Rivers Camp in the Okavango Swamps (1923 A1) agree with Laurent's morphological specifications for *microps*: fifth toe 75–93% of metatarsal tubercle, width of upper eyelid 34–57% of fifth toe and 22–28% of interorbital distance, internarial distance 52–61% of the eye–nostril distance. Two of the five specimens have the sprinkling of the minute white dots characteristic of *microps*, and these dots are just evident in a third specimen. A light vertebral line is present in all the specimens, a feature which occurs sporadically in *g. microps* and in *g. guineensis*, and there is marbling of the dorsal surface, a feature of *g. guineensis* but a condition noted in only one specimen of *g. microps* by Laurent. In the Four Rivers material this marbling tends to be formed into oblique light-and-dark banding, and the light lateral blotching is also peculiar in being formed into a longitudinal light band on the right side.

A 44 mm female (NMZB 7230) from Xaxaba, further south in the Okavango Swamps (1923 C1), agrees well with the Four Rivers series, although the internarial/eye–nostril distance percentage is 65,8%, and the right side shows only a faint, discontinuous line. The markings of the Four Rivers series are well shown in two TM specimens (44828 & 39330) from Chiefs Island, Okavango Swamps (1923 A3) and Linyanti, eastern Caprivi. Morphologically, these two specimens fall within the range of variation of the Four Rivers series in all the features noted above, apart from a width eyelid/interorbital distance of 29% in the Linyanti specimen. While these markings differ from the specimens of *microps* discussed by Laurent, wide ranges of variation in markings are accepted by Laurent in other *guineensis* subspecies, and it seems most practical to keep to morphometric characters in the diagnosis of the various forms.

A 43 mm female in the TM (46298) from Katima Mulilo, eastern Caprivi, shows the more usual markings of *microps* in lacking a vertebral line and in having only faintly discernible mottling, with a clearly evident sprinkling of minute white dots. Morphologically, it falls within the range of variation shown by the Four Rivers series, and of *microps* generally.

The remaining specimen listed here as *microps* (NMZB 19243) is from Ikelenge, Zambia (1124 A2), which is within the geographical range of Laurent's material. It conforms to Laurent's morphological specifications for *microps*: fifth toe 113% of metatarsal tubercle, width upper eyelid 37% of fifth toe, internarial distance 52% of eye–nostril distance. It has barely discernible mottling dorsally, a few minute white dots, and a fine and somewhat wavy light line over the scapular region and posterior half of the urostyle.

Distribution. Southern Zaïre, Angola, Zambia, northern Botswana.

Localities. See Poynton 1982, Fig. 3. BOTSWANA. Chief's Island (TM), Four Rivers Camp (NMZB), Xaxaba (NMZB). CAPRIVI. Katima Mulilo (TM), Linyanti (TM). ZAMBIA. Ikelenge (NMZB). Lealui (Laurent 1972).

Hemisus wittei Laurent

Hemisus wittei Laurent, 1963: 397. Mabwe, Upemba National Park, Zaïre. Holotype in the Musée Royal de l'Afrique Centrale, Tervuren. Laurent 1972: 59.

Diagnosis and description. See Fig. 13. Males reaching 30–40 mm, females 36–53 mm. Free part of fifth toe 65–120% of inner metatarsal tubercle, width upper eyelid 55–80% of free part of fifth toe, width upper eyelid 20–45% of interorbital distance, internarial distance 65–90% of eye–nostril distance, eye–nostril distance 60–90% of length upper eyelid. Dorsal coloration marbled, but leaving a broad light vertebral band, bounded on either side by irregular but usually pronounced dark longitudinal bands. Rest of marbling tending to be arranged in longitudinal to oblique patterning. Dorsal skin of adults usually noticeably roughened.

Habitat. No data available.

Remarks. As Laurent (1972) has observed, the taxonomy of the limited material assigned to *wittei* is still uncertain. The only known specimen from Zambia, BM 1976. 340 from Mweru Wantipa, evidently has not been identified by Laurent. It is a 30 mm male. In size it agrees with the Pweto specimens which Laurent noted are smaller than the Upemba types. In roughness of skin and coloration, as well as in morphometric features, the Mweru Wantipa specimen agrees with the types, apart from the fifth toe being substantially longer than the inner metatarsal tubercle, in which feature it agrees with the Pweto specimens. Laurent's inclusion of the Mweru and Upemba material in a single taxon does, however, seem justified at present.

Distribution. Lowland areas of southern Shaba (Upemba Park and Lake Mweru) and of northwestern Zambia.

Locality. ZAMBIA. Mweru Wantipa (BM).

Family ARTHROLEPTIDAE

Seven well-defined genera are listed by Dubois (1981) under this family, all occurring in West Africa. Only one of these, *Arthroleptis* (including *Coracodichus* and *Schoutedenella*), extends into eastern and southern Africa.

Genus *Arthroleptis* Smith

Arthroleptis Smith, 1849: 24. Type by monotypy: *A. wahlbergii* Smith.
Schoutedenella de Witte, 1921: 18. Type by monotypy: *S. globosa* de Witte.
Coracodichus Laurent, 1940: 85. Type by original designation: *Arthroleptis whytii* Boulenger.

Squeakers and Cricket Frogs. Pupil horizontal. Vomerine teeth absent. Omosternum ossified and forked, procoracoid-clavicular bars fully ossified, metasternum cartilaginous, small and usually rod-like. Toes without webbing. A fine skin ridge running from tip of snout to tip of urostyle usually visible, as is also an hour-glass pattern on the back. Third finger in male fairly to greatly elongated.

Widespread in Subsaharan Africa, excluding Namibia, Botswana, and South Africa apart from the eastern lowlands. Where known, eggs laid away from water, in litter or humus; tadpoles developing within the egg capsule. Occurring in forest, scrub or dense grass, sometimes in the shelter of caves and rocks.

The genus as here recognised seems to be a comprehensive morphological and ecological unit. Proposals to break it into a number of full genera, put forward mainly by Laurent (eg. 1973), seem to be without any particular advantage, especially as the proposals lack a wide-ranging synthesis of data (Poynton 1976). *Schoutedenella* was distinguished from *Arthroleptis* by de Witte solely on the grounds of a lack of maxillary teeth. This has not proved to be a wholly reliable 'character' (Laurent 1954). Recently it has become the practice with some authors to place all small-sized species in *Schoutedenella*, although in the case of the small-sized *xenodactyloides*, possession of maxillary teeth and morphometric agreement with *wahlbergii* (such as shown in the length of the third finger in the male) place this species in *Arthroleptis s.s.* according to features that Perret (1966) selects. At our present state of knowledge, to separate such similar species as *xenodactyloides* and de Witte's *globosa* into different genera merely reduces, we believe, the usefulness of the genus rank.

Key to the Zambesiaca species of *Arthroleptis*

1	Metatarsal tubercle as long as or longer than outer or inner toe	**stenodactylus**
—	Metatarsal tubercle shorter than outer or inner toe	2
2	Adult minute, snout–urostyle tip length not more than 23 mm	3
—	Adult length more than 23 mm	4
3	Metatarsal tubercles less than half length of outer toe, not larger than subarticular tubercles of toes	**xenodactyloides**
—	Metatarsal tubercles longer than half length of outer toe, about twice the size of the subarticular tubercles of the toes	**xenochirus**
4	Digital discs or swellings present	5
—	No digital discs or swellings	**troglodytes**
5	Discs on fingers 2–4 dilated to more than width of subarticular tubercles of fingers	**reichei**
—	Discs on fingers 2–4 not broader than width of subarticular tubercles of fingers	**francei**

Arthroleptis stenodactylus Pfeffer

Arthroleptis stenodactylus Pfeffer, 1893 : 93, pl. 1, fig. 11. Kihengo, Tanzania. Type destroyed. Parker 1930 : 899, Loveridge 1933 : 376, FitzSimons 1939 : 41, Poynton 1964*a* : 163 & 1964*b* : 212 & 1966 : 24, Stewart 1967 : 104, Broadley 1971 : 118, Stevens 1974 : 8.

Arthroleptis whytii Boulenger, 1897 : 802, pl. 46, fig. 3. Kondowe to Karonga; Nyika Plateau; Misuku Mountains, Malaŵi (restricted to Misuku Mountains by Loveridge 1953*a*). Syntypes in the British Museum (N.H.), London. Boulenger 1907*a* : 482.

Arthroleptis stenodactylus whytii Boulenger; Loveridge 1953*a* : 389.

Arthroleptis stenodactylus stenodactylus Pfeffer; Loveridge 1953*a*: 391.

Diagnosis and description. Maximum size 42 mm. Stocky build, length of tibia a third to less than half length of body, equal to or less (in males and large females) than width of head. Metatarsal tubercle raised, flangelike with sharp edge, as long as or longer than outer toe. Third finger in male not more than three-quarters width of head, usually less. No digital discs. Markings highly variable (see Remarks).

Habitat. A versatile species, found in evergreen forest, miombo woodland or in thickets in more open savanna. Males may be heard calling in large numbers during and just after rain, but are difficult to find amongst leaf litter.

Remarks. The dorsal markings appear to be particularly variable in this species. Almost any series of five or more specimens will contain individuals with no discernible markings (except a pair of dark sacral spots) to those with the typical *Arthroleptis* three-lobed dorsal band, sometimes with a fine light vertebral line. A prominent light vertebral band is more rarely present. In an unbiased sample of 18 specimens taken from a trench at Xiluvo, representation of the different patterns is:

No easily discernible pattern	6
Dark three-lobed band	6
Three-lobed pattern + light line	5
Three-lobed pattern + light vertebral band	1

This seems representative of the species as a whole, and a study of this polychromaticism along the lines of Stewart (1974) in *Phrynobatrachus* needs to be undertaken.

Females in the Xiluvo series vary from having an immaculate to very speckled ventral surface, confirming the valuelessness of ventral markings as a taxonomic character (Poynton 1964*a*, cf. Loveridge 1953*a*). Variation in the degree of ventral speckling in this series does not show any relationship with the variation in the dorsal markings.

Distribution. North-eastern South Africa, Mozambique to Kenya, westwards to Shaba and Zambia.

Localities. ZAMBIA. Bwana Mkubawa (NMZB), Chikowa (NMZB), Chipangali (NMZB), Chipata (NMZB), Chunga (NMZB), Ikelenge (NMZB), Kalikali/Kongwe (NMZB), Kanjenjesi Hills (NMZB), Katete/Lupande (NMZB), Kaungashi River (NMZB), Lake Chila (BM), 8 km E Lusaka (BM), Lusangazi (NMZB), Maiyumba (BM), Mbala (BM, NMZB), Mkanda (NMZB), Mungwe (BM), Ndola (NMZB), Salujinga (AMNH). Ikomba (Loveridge 1933). MALAŴI. Chikangawa (NMZB), Chikwawa (TM), Chisambo Estate (NMZB), Kondowe/Karonga (BM), Lifupa (NMZB), Lilongwe (NMZB), Lujeri (NMZB), Makoka A.R.S. (BM), Misuku Mountains (BM), Mulanje Mountain (Madzeka Basin) (NMZB), Mzimba (BM), Ngara (NMZB), Nkhata Bay (NMZB), Nkwadzi Hill (NMZB), Nyika Plateau (BM), Rumpi (NMZB), Zomba (BM, NMB, NMZB), Zomba Mountain (BM), Blantyre; Chitala River; Likabula River; Ntchisi Mountain; Thyolo Mountain; Zomba (Loveridge 1953*a*), Mangochi; Nsanje (Loveridge 1953*b*), Blantyre; Chikangawa (Stewart 1967). MOZAMBIQUE. Amatongas (BM, NMZB), Beira (BM), 16 km NE Beira (NMZB), Chimonzo

(NMZB), Dondo (NMZB), Dondo Forest (TM), 8 km NW Dondo (NMZB), 10 km NE Dondo (NMZB), Garuso (NMZB), Gondola–Gorongoza Pontoon (NMZB), Inchope (NMZB), 10 km NE Inhaminga (NMZB), Machipanda (NM), Macia (SAM), Maforga (NMZB), Makurupini River (NMZB), Manga (NMZB), Mavita (NMZB), Metuchira (NMZB), Mitucue Mountain (NMZB), Morrumbala (NMZB), Muda–Lamego (NMZB), Ponta de Ouro (TM), Ribaue Mountain (NMZB), Vila de Manica (NMZB), 24 km SE Vila de Manica (NMZB), 40 km NE Vila Paiva de Andrada (NMZB), Vila Pery (NMZB), Viola (NMZB), Xiluvo (NMZB). ZIMBABWE. Bomponi (NMZB), Charama Plateau (NMZB), Chimanimani Mountains (NM), Chinyamanda (NMZB), Chirinda Forest (TM, NMZB), Chishawasha (AM), Chiso (NMZB), Chivake River Bridge (NMZB), Dora (NMZB), Gairezi Bridge (NMZB), Gokwe (NM, TM), 48 km NW Gokwe (TM), Great Zimbabwe (NMZB), Haroni Forest (NMZB), Hayfield B (NMZB), Inyanga N.P. (NMZB), Jersey Tea Estate (NMZB), Kaitano (NMZB), Lower Mtarazi River (NMZB), Lundi River Bridge (NM), Mahenya (NMZB), Mhangura (NMZB), Mount Selinda (BM), Mukuti (NMZB), Mutare (NMZB), Musapa Gap (NMZB), Musirizwe River (NMZB), 50 km NE Mutoko (NMZB), Navisikana, Gonarezhou (NMZB), Ngorima C.L. (East) (NMZB), Pachanza (NMZB), Pungwe Gorge (NMZB), Ranelia Farm (NMZB), Rukomeshe Research Station (NMZB), Selborne (NMZB), Sengwa Gorge (NMZB), Silverstreams (NMZB), Smalldeel (NMZB), Stapleford (NMZB), Toronto (NMZB), Udu Dam (NMZB), Vumba Mountain (NMZB), Watsomba (NMZB), Zimunya C.L. (NMZB).

Arthroleptis francei Loveridge

Arthroleptis macrodactyla; Günther (not Boulenger) 1893 : 619, Johnston 1897 : 362 & 1898 : 361.
Arthroleptis adolfifriederici francei Loveridge, 1953*a* : 387. Ruo River, Mount Mulanje, Malaŵi. Holotype in the Museum of Comparative Zoology, Harvard. Poynton 1964*b* : 231, Stewart 1967 : 108, Stevens 1974 : 8.

Diagnosis and description. Maximum size 47 mm. Fairly stocky build, length of tibia half or (more usually) less than half length of body, more than width of head. Metatarsal tubercle raised but not flange-like, less than half length of outer toe. Third finger in male half to two-thirds width of head. Tips of toes dilated, broader than subarticular tubercles, but tips of fingers not broader.

Dorsal markings: three-lobed *Arthroleptis* pattern very faint (not evident in a few specimens) to strongly emphasised by light background area. One specimen with asymmetrical light patch on a dark ground. Naso-frontal area may be slightly to much lighter than rest of dorsal surface, and sometimes delimited by a dark interocular bar. Gular and pectoral region almost immaculate to densely marbled in females, sometimes spreading to abdomen; males with darker, almost black, gular region.

Habitat. This species is abundant in forests on Mulanje Mountain, both in moist lowland evergreen forest in the lower Ruo Gorge and also in relatively dry cedar (*Widdringtonia*) forest on the summit. A specimen was found in open grassland with pine plantations on the Lichenya Plateau. Stevens (1974) states that it 'replaces *A. stenodactylus* in the rain forests but is sympatric with it on the plateau'.

He reports a tendency to climb, and one specimen was found 'concealed under the loose bark of a standing tree two metres from the ground'.

Remarks. Loveridge (1953*a*) rejected the locality record of 'Zomba' attached to a BM specimen (93.10.26.80) which he identified as *francei*. Although macerated, the specimen agrees very well with a *francei* paratype of similar size in the BM. Loveridge has left no reason for rejecting this locality, which could perhaps refer to Zomba Mountain rather than to the town below it.

Skelton-Bourgeois (1961) removed the Usambaran *A. affinis* from the synonymy of *adolfifriederici* Nieden, into which Loveridge had placed it. Comparison of *francei* with these two species and with the Usambaran *tanneri* (Grandison 1983) shows no degree of similarity with any of them that would justify subspecific status, although similarities seem to be somewhat greater with *affinis*, particularly the possession of supernumerary tubercles under the metatarsals.

Distribution. Mulanje Mountain and possibly Zomba Mountain, Malaŵi.

Localities. MALAŴI. Mulanje Mountain: Ruo Gorge Forest (NMZB), Madzeka Basin (NMZB), Lujeri–Madzeka (NMZB), Chambe Basin (NMZB), Zomba (BM).

Arthroleptis reichei Nieden

Arthroleptis reichei Nieden 1910: 437. Crater Lake, Poroto Mountains, Tanzania. Type in the Zoologisches Museum, Berlin. Loveridge 1953*a*: 386, Poynton 1964*b*: 213, Stewart 1967: 106.

Diagnosis and description. Maximum size 34 mm. Fairly slender, length of tibia half to more than half length of body, much more than width of head. Metatarsal tubercle raised but not sharply flanged, less than a third of the length of the outer toe. Second to fourth fingers with distinct discs, broader than width of subarticular tubercles, toes with discs. Typical *Arthroleptis* markings in the three specimens known from Malaŵi. These specimens are female: males have not yet been collected. Length of third finger slightly more than half width of head in Tanzanian males.

Habitat. Loveridge's specimen (1953*a*) was collected under a log in the Matipa Forest. The two NMZB specimens were collected near a stream in the Mugesse Forest.

Distribution. Virgin forests of southwest Tanzanian mountains and Misuku Mountains, northern Malaŵi.

Localities. MALAŴI. Misuku Mountains: Matipa Forest (MCZ) and Mugesse Forest (NMZB).

Arthroleptis troglodytes Poynton

Arthroleptis troglodytes Poynton, 1963: 327. Chimanimani Mountains, Zimbabwe. Holotype in the National Museum, Bulawayo. Poynton 1964*a*: 161.

Diagnosis and description. Maximum size 27 mm. Fairly slenger, length of tibia half or (more usually) less than half the length of body, more than width of head. Metatarsal tubercle weakly developed, less than a third the length of the outer toe. Third finger in male about half width of head. No digital discs. An *Arthroleptis* pattern is shown in some specimens, but usually broken up by light mottling and other irregularities.

Habitat. No new material has been collected since the species was first described. Most of the sixteen specimens were found in sink-holes or caves and a few in open grassland on the Chimanimani Mountains. None was taken in forest.

Distribution. Known only from the western Chimanimani Mountains, Zimbabwe.

Localities. ZIMBABWE. Western Chimanimani Mountains above 1 500 m (NMZB).

Arthroleptis xenochirus Boulenger

Arthroleptis xenochirus Boulenger, 1905: 108, pl. 4, Figs 2, 2a. Marimba, Angola. Holotype in the British Museum (N.H.), London.

Schoutedenella globosa de Witte, 1921 : 12, pl. 4, Fig. 1. Lofoï, Zaïre. Types in the Musée Royal de l'Afrique Centrale, Tervuren.

Arthroleptis xenodactyloides xenodactyloides, (part, not Hewitt); Poynton 1964*b* : 213, Stewart 1967 : 110.

Arthroleptis xenodactyloides nyikae, (part, not Loveridge); Poynton 1964*b* : 213, Stewart & Wilson 1966 : 303, Stewart 1967 : 110, Broadley 1971 : 119.

Arthroleptis globosa (Witte); Broadley 1971 : 118.

Diagnosis and description. Maximum size 22 mm. Stocky build, length of tibia a third to less than half length of body, subequal (especially in males) to more than width of head, except in Nyika Plateau specimens where it may be less than width of head. Metatarsal tubercle strongly projecting and spur-like, about twice the size of the subarticular tubercles of the toes, more than half the length of the outer toe (except in Nyika Plateau material). Third finger in male much longer than width of head in fully grown specimens, but less in juveniles, showing marked allometric relationship to body size (see Remarks). No digital discs to slight terminal expansion. Adults tend to lack dorsal markings, but the *Arthroleptis* hour-glass pattern is evident at least in juveniles.

Habitat. Near streams in open grassland or forest patches (Stewart & Wilson 1966).

Remarks. Zambian material has been compared with the types of *xenochirus* and of *globosa*, and can be distinguished from neither. Laurent (1964 : 146) noted that 'les rapports entre *Sch. xenochirus* et *Sch. globosa* sont peut-être subspécifiques', without suggesting any means of separation: we find no reason not to treat them as conspecific. Schmidt & Inger (1959) did not discuss the possibility of conspecificity, neither did de Witte when he described *globosa*. The available Zambesiaca material (37 specimens in all), excluding material from the Nyika Plateau to be discussed later, fits the scatter diagrams of Schimdt & Inger (1959, Figs 56 & 57) which plot finger, tibia and foot lengths against body length in Upemba material (identified as *globosa*). Tibia length plotted against body length in the Zambesiaca material is shown in Fig. 14, and confirms Schmidt & Inger's conclusion (p. 129) that 'neither the tibia nor the foot grows appreciably after the frog has reached a certain age (*ca.* 17 mm)'. As shown in Fig. 14, the single type of *xenochirus* also fits this diagram well, as do most of the syntypes of *globosa*. The male *xenochirus* type also fits Schmidt & Inger's Fig. 56, which plots length of third finger (5,4 mm in the type) against body length (17,9 mm snout to urostyle tip in the type).

Laurent (1964) retrieved de Witte's *A. lameerei* from Schmidt & Inger's table of

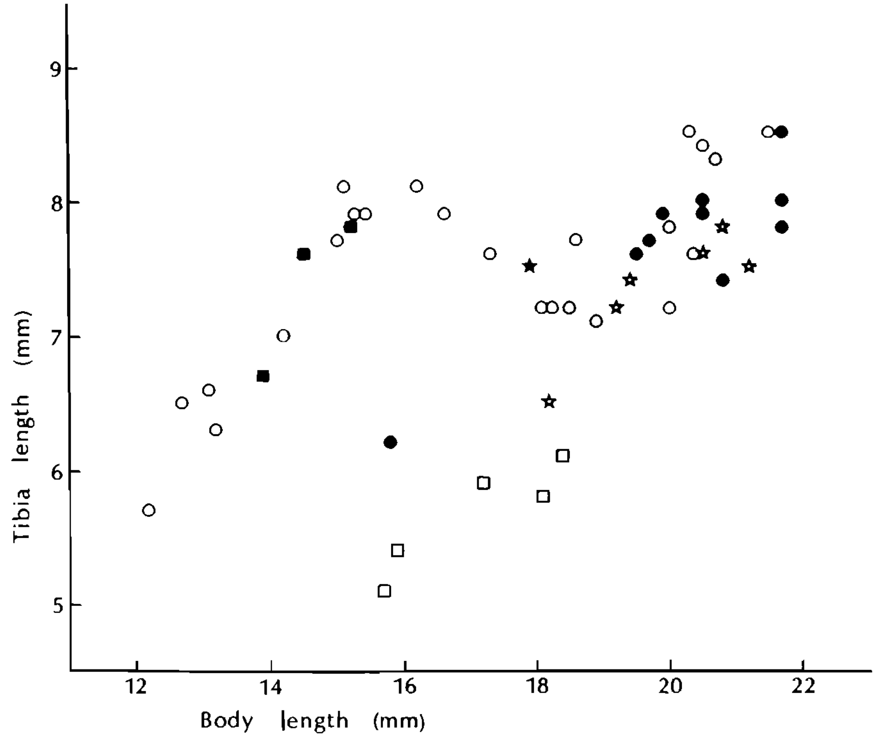

Fig. 14. Relationship between tibia length and body length in *Arthroleptis xenochirus*. ★ *xenochirus* type, ☆ *globosa* types, ● western Zambia, ○ northern Zambia, ■ northern Malaŵi, □ Nyika Plateau.

synonymy of *globosa* 'n'est pas sans hésitation'. The Angolan material assigned by Laurent to *lameerei* was separated from *xenochirus* on the basis of relatively greater limb length (his *xenochirus* being represented by two large females whose body proportions agree with our material). The foot/body length ratio given for his smaller '*lameerei*' specimens was 44,9% to 54,2%, a range which includes values given by nine out of thirteen Zambian specimens below a body length of 17,5 mm (foot/body ratio 39,9–55,6%). However, Laurent reported one specimen as having a body length of 20 mm and a foot length of 9,7 mm, which places it substantially outside the range of all recorded Zambesiaca and Upemba material.

In contrast to this, specimens collected on the Nyika Plateau in Zambia and Malaŵi have substantially shorter hind limbs. This material was confused with *A. xenodactyloides nyikae* by Poynton (1964*b*) and Stewart (1967), the specimen illustrated on the left hand side of Stewart's Fig. 46 being referable to *xenochirus*. This short-legged frog was collected on the Nyika Plateau by Stewart, Wilson and Keith, but not by Loveridge, whose series of *xenodactyloides nyikae* is homogeneous. The extreme shortness of the hind limb shown by the five existing Nyikan specimens, here referred to *xenochirus*, could possibly be taken as grounds for taxonomic separation: their distinctness is shown in Fig. 14. Hind limb measurements of the specimens are shown in Table 2.

TABLE 2

Hind limb measurements of *Arthroleptis xenochirus* from the Nyika Plateau.

	1. body	1. tibia	1. foot
NMZB 11430	18,4	6,1	6,5
11431	15,7	5,1	5,3
11432	15,9	5,4	5,7
9605	18,1	5,8	5,8
AMNH 73876	17,2	5,9	5,5

The mean for 1. tibia/1. body is 33,2% (range 32,0%–34,3%): for 1. foot/1. body the mean is 33,8% (range 32,0%–35,8%). The Zambesiacan specimen closest to the Nyikan material on the scatter diagram is AMNH 73865 from Salujinga, with a body length of 15,8 mm and tibia length of 6,2 mm. As Salujinga is in western Zambia, an east–west cline in limb length is not indicated by this specimen, nor by any other material. One of the *globosa* syntypes also comes fairly close to the range of the Nyikan material (Fig. 14).

The three available Nyikan males conform to the rest of the Zambian and Upemban specimens in the relative length of the third finger, and also in the elongation of the forelimb, whose length (distance from arm insertion to carpus) falls within 51–56% of body length in all material, except in one Salujinga male which shows 63%. No other features emerge in the small collection from Nyika Plateau which clearly distinguish the specimens from other Zambesiacan or Zaïre *xenochirus*, and, bearing in mind the variation shown in hind limb length by *xenodactyloides* (see Remarks under that species), it seems inadvisable at this stage to assign the Nyikan specimens to a new taxon.

Juveniles and females of this species are easily confused at first sight with *xenodactyloides* females. The strong development of the metatarsal tubercle and absence of maxillary teeth are serviceable characters. In adult males the greatly elongated forelimb and third finger are unmistakable features, and their exact significance in mating is in need of clarification. The testes of this species are unpigmented, in contrast to the pigmented condition of *xenodactyloides*.

Distribution. Upland areas of nothern Malaŵi, Zambia, Angola and south-eastern Zaïre.

Localities. ZAMBIA. Chilonoma (BM), Kasama (NMZL), Lake Chila (BM, NMZB), Lucheche (BM), Mayau River (AMNH), Mbala (BM, NMZL), Muchinga Escarpment, Serenje (NMZB), Nyika Plateau (NMZB), Salujinga (AMNH). MALAŴI. Matipa Forest (NMZB), Misuku Mountains (NMZB), Nchenachena (NMZB), Nyika Plateau (NMZB).

Arthroleptis xenodactyloides Hewitt

Arthroleptis xenodactyloides Hewitt, 1933: 49. Chirinda Forest, Zimbabwe. Syntypes in the National Museum, Bulawayo.

Arthroleptis xenodactyloides nyikae Loveridge, 1953*a*: 213. Part: Poynton 1964*b*: 213, Stewart 1967: 112, Stjernstedt 1973: 196.

Arthroleptis boulengeri; Loveridge (not de Witte) 1953*a* : 384.
Arthroleptis xenodactyloides xenodactyloides Hewitt; Poynton 1964*a* : 162 & 1964*b* : 213 & 1966 : 24, Stewart 1967 : 110, Stevens 1974 : 8.

Diagnosis and description. Maximum size (in Zambesiaca region) 21 mm, usual size less than 20 mm. Relatively slender build, length of tibia more than a third to more than half length of body (see Remarks), decidedly more than width of head. Metatarsal tubercle minute, not larger than the weakly developed subarticular tubercles of the toes, very much less than length of outer toe. Third finger in male not more than two thirds width of head. Digital discs normally distinct. Typical *Arthroleptis* pattern usually very distinct; a pair of light dorsolatral bands sometimes present, in which case the hour-glass pattern is absent. The testes in this species are almost black.

Habitat. Common in both montane and lowland forests and dense woodland; at high elevations also collected in dense swampy grassland.

Remarks. Hewitt (1933) reported that *xenodactyloides* was 'chiefly distinguishable from *xenodactylus* on the shorter hind-limb', although he noted that 'the new form may perhaps have to rank as a sub-species of *xenodactylus*'. His conception of *xenodactylus* was evidently based on four MCZ specimens from Amani, the Usambaran type locality of *xenodactylus*. These ex-MCZ specimens are housed in the AM and TM. Examination of more MCZ material from Amani, all referred to *xenodactylus*, shows that in fact two different species are represented, one of which agrees with the type of *xenodactylus*, while the second—which includes the material examined by Hewitt—differs from the *xenodactylus* type in the following main respects. In *xenodactylus* the pads of the finger and toe discs continue into a papillate projection, unlike the rounded discs (at least of adults) of the second species; *xenodactylus* lacks the typical dorsal *Arthroleptis* pattern of the second species, being speckled or vermiculated if marked at all; and in *xenodactylus* the snout has a characteristically flattened appearance, almost wedge-shaped in profile, the vertical height of the snout at front lip level not exceeding 17% of the head length. The vertical height is greater than 17% head length in the second species, which in profile has a blunt snout.

The occurrence of these two species at Amani has been confirmed by BM material collected by Miss A. G. C. Grandison, and also by material in the ZMC collection. Available material suggests that *xenodactylus*, correctly understood, is much more restricted in range than is generally indicated in the literature, being apparently confined to the Usambaras. The second small-sized species at Amani is, as Hewitt observed, very similar to his Chirinda types of *xenodactyloides*, the chief difference lying in the length of the hind limb. This difference, however, now has to be considered against the variation in limb length shown by the currently available material. This variation is shown in Table 3, in which all series from the Zambesiaca area containing four or more specimens with a body length of over 13,5 mm are graded according to mean tibia/body length. Amani material is included for comparison.

TABLE 3

Tibia length in series of *Arthroleptis xenodactyloides*.

Locality	*n*	*Mean tibial/ body length (%)*	*Range*
Lujeri	5	40	34–45
Chirinda Forest	55	40	36–46
Gorongoza Mt.	5	40	35–47
Cholo Mt.	5	40	38–42
Vipya Plateau	4	41	39–44
Ngorima	14	41	38–46
Gleneagles	9	42	34–47
Pungwe Gorge	4	42	39–46
Morrumbala	4	42	39–45
Mugesse Forest	11	45	42–48
Haroni Forest	6	45	40–49
Chiniziua	4	46	45–46
Nchisi Mt.	6	47	45–49
Erego	7	47	44–52
Ribaue Mt.	10	48	43–52
NE Beira	15	48	43–52
Zomba Plateau	5	49	44–55
Amatongas	12	50	47–52
Nyika Plateau	6	50	47–53
Chiradzulu Mt.	14	52	50–55
Amani	25	52	41–59

The table indicates the presence of quite considerable variation in relative length of the hind limb. There is a marked tendency for the range of variation to be small within the series from any one locality, suggesting the formation of demes, which is not surprising in a species whose geographical distribution is fragmented by a patchy forest habitat. No very strong altitudinal or latitudinal trends are shown in the variation, and the Amani specimens do not form a separable set. The difference that Hewitt noted between Chirinda and Amani material does not therefore appear to be taxonomically significant.

Material clearly referable to this species occurs in other eastern parts of Tanzania (eg. Mahenge, Poynton 1977), although not in Kenya. The wide distribution of this species raises the possibility of there being one or more senior synonyms of *xenodactyloides*. Loveridge (1953*a*) referred Malaŵian material to *boulengeri* de Witte 1921, from west of Lake Tanganyika. Comparison of some of Loveridge's material with the type of *boulengeri* shows marked similarity, the main difference being the more broadly expanded and rounded toe discs of *boulengeri*. Toe discs do indeed show some variation in *xenodactyloides*, but until variation in the small *Arthroleptis* of the whole region is better known, and supported with field data, it seems premature to consider synomymising eastern material with species described from Zaïre.

Specimens from the Nyika Plateau which appear to be conspecific with *xenochirus* were confused with Loveridge's *xenodactyloides nyikae* by Poynton (1964*b*) and Stewart (1967) (see Remarks under *xenochirus*). The 'peculiar features of the Nyikan material' noted by Poynton (1964*b* : 213), which were supposed to distinguish Loveridge's *nyikae* from *x. xenodactyloides*, are in fact more characteristic of *xenochirus* (see Remarks under that species). The paratype series of *nyikae* does not seem to be clearly distinguishable from the variation of *xenodactyloides* as here understood. The ventral pigmentation of the *nyikae* series, used as a diagnostic character by Loveridge, is slightly heavier in some specimens than in any other available Zambesiaca specimens, yet a tendency towards ventral pigmentation is a feature of most series from the Vipya Plateau northwards, and occurs sporadically in series to the south, including Zimbabwe. A particularly heavily pigmented specimen of *nyikae* is illustrated by Stewart (1967, Fig. 46, right side). It seems impossible to separate the *nyikae* series from *xenodactyloides* as a whole on this feature, and no other feature seems to present itself as a basis for separation. The same appears to be true of Loveridge's *xenodactyloides nkukae* (1942) from mountains just to the north of Malaŵi, also diagnosed by Loveridge mainly on its possession of ventral pigmentation. The mean tibia/body length percentage of the fourteen *nkukae* paratypes examined is 40, with a 38%–43% range. It must again be said, however, that the taxonomy of small-sized *Arthroleptis* material from Tanzania is still far from clear.

Distribution. Disjunct populations in mainly forested areas of eastern Zimbabwe, Mozambique, Malaŵi, Zambia and Tanzania.

Localities. ZAMBIA. Kachalola (AMNH). MALAŴI. Chikangawa (NMZB), Chiradzulu Mt. (MCZ), Chisenga (NMZB), Likabula (MCZ, NMZB), Livingstonia (NMZB), Lujeri (NMZB), Madzeka Basin, Mulanje (NMZB), Matipa Forest (NMZB), Misuku Mt. (NMZB), Mugesse Forest (NMZB), Nchenachena Falls (MCZ), Nkhata Bay (NMZB), Nkhonjera Mt. (NMZB), Ntchisi Mt. (MCZ), Ruo Gorge (NMZB), Thyolo Mt. (MCZ, NMZB), Zomba Plateau (MCZ). Chitipa; Rumpi (Stewart, 1967). MOZAMBIQUE. Amatongas (NMZB), 16 km NE Beira (NMZB), Chiniziua Dist. (NMZB), 8 km NW Dondo (NMZB), 20 km S. Erego (NMZB), Garuso (NMZB), Gorongoza Mt. (NMZB, TM), Luala River Bridge (NMZB), Makurupini (NMZB), Mitucué Mt. (NMZB), Morrumbala Mt. (NMZB), 16 km N Mugeba (NMZB), Ribáuè Mt. (NMZB). ZIMBABWE. Banti Forest Reserve (NMZB), Bridal Veil Falls (NMZB), Cecil Kop, Mutare (NMZB), Chimanimani Mts. (NM, NMZB), Chirinda Forest (NM, NMZB, TM), Dunblane (NMZB), Engwa (NMZB), Gleneagles (NMZB), Haroni Forest (NMZB), Haroni–Rusitu Confluence (NMZB), Hayfield B (NMZB), Inyanga N.P. (NMZB), Lower Mtarazi River (NMZB), Ngorima C.L. (NMZB), Penhalonga (NMZB), Pungwe Gorge (NMZB), Stapleford (NMZB), The Corner (NMZB), Vumba Mtn. (NMZB).

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GAZETTEER

Key to abbreviations.

Countries

BO = Botswana
CA = Caprivi Strip (Namibia)
MA = Malaŵi
MO = Mozambique
ZA = Zambia
ZW = Zimbabwe

Areas

C.H.A. = Controlled Hunting Area
C.L. = Communal Lands (formerly Tribal Trust Lands)
F.R. = Forest Reserve
F.S. = Field Station
I.C.A. = Intensive Conservation Area
N.P. = National Park

Locality	*Country*	*Quarter-degree Grid Reference*
Abercorn (now Mbala)	ZA	0831 C4
Alves de Lima	MO	2134 A2
Amamba	MO	2033 B2
Amatongas	MO	1933 B2
Ambi Falls	ZW	1630 B3
Antelope Mine	ZW	2128 A2
Atlantica	ZW	1730 D4
Banti Forest Reserve	ZW	1932 B4
Bazaruto Island	MO	2135 C2
Beira	MO	1934 D4
Bembezi Siding & Village	ZW	1928 D4
Bikita	ZW	2031 B1
Bilili Hot Springs	ZA	1626 C2
Birchenough Bridge	ZW	1932 C4
Blantyre	MA	1535 C3
Boane	MO	2632 A2
Bomponi	ZW	1932 B2
Boroma	MO	1633 A2
Boror	MO	*c.* 1736 C
Bridal Veil Falls	ZW	1932 D4
Broken Hill (now Kabwe)	ZA	1428 A4
Buffalo Bend, Gonarezhou N.P.	ZW	2131 C4
Buffalo Range	ZW	2131 B1
Bulawayo	ZW	2028 B1
Bundi Valley	ZW	1933 C3
Bushman Mine	BO	2026 D1
Butler North Farm	ZW	1932 B4
Butsingwango River	BO	2121 C3
Buzi River at 600 m	MO	2032 B4
Bwana Mkubwa	ZA	1328 B1
Bwaye River	MA	1034 A1
Cabaceira Peninsula	MO	1440 D4
Canganetole	MO	1834 A4
Cashel	ZW	1932 D2
Cecil Kop	ZW	1832 D3
Chakwenga River	ZA	1529 D1
Chambajojo	MO	2133 B4
Charama Plateau	ZW	1828 B1
Charara Confluence, L. Kariba	ZW	1628 D2
Charre	MO	1735 A3
Chemezi	MO	1833 C3
Chete Gorge	ZW	1727 B3
Chibi	ZW	2030 A4
Chief's Island, Boro River	BO	1923 A3
Chigubo	MO	2233 D3
Chikangawa	MA	1133 D4
Chikowa	ZA	1332 A3
Chikwa	ZA	1132 D2
Chikwawa	MA	1634 B2
Chilimanzi	ZW	1930 D1
Chilonga	ZW	2131 B1
Chimanimani Mountains (East)	ZW	1933 C3
Chimene Stream	ZA	1727 C1
Chimonzo	MO	2433 C4
Chinhoyi (formerly Sinoia)	ZW	1730 A3
Chiniziua	MO	1835 C3
Chinsali	ZA	1032 C1
Chinyamanda	ZW	1932 B4
Chipangali	ZA	1332 B1
Chipata (formerly Fort Jameson)	ZA	1332 D1
Chipinda Pools	ZW	2131 B4
Chipoka	MA	1334 D3
Chiradzulu Mountain	MA	1535 C1
Chiredzi	ZW	2131 B1
Chirinda Forest	ZW	2032 B3
Chiromo	MA	1635 C1
Chisambo Estate	MA	1635 B1
Chisenga	MA	0933 C4
Chishawasha	ZW	1731 C3
Chiso	ZW	2032 C2
Chitala River	MA	1334 C2
Chitengo	MO	1834 C4
Chitipa (formerly Fort Hill)	MA	0933 C2
Chitza, Gonarezhou N.P.	ZW	2132 A4
Chivake River Bridge	ZW	1731 D1
Chivirira Falls	ZW	2132 A2
Chiwanda	ZA	1331 D4
Chiwondo, Lake	MA	1033 B2
Chizarira Range	ZW	1727 D3
Cholo (now Thyolo)	MA	1635 A1
Chowe	MA	1435 C1
Chunga	ZA	1526 A1
Cleveland Dam	ZW	1731 C3
Cyrene Mission	ZW	2028 A4

Locality	*Country*	*Quarter-degree Grid Reference*
Dambwa F.R.	ZA	1725 D4
Deteema Dam, Hwange N.P.	ZW	1826 C1
Dem River Farm	ZA	1528 C2
Devure River Bridge	ZW	1932 C3
Dimba Dambo	ZA	1625 D2
Dondo	MO	1934 D1
Dora, Mutare	ZW	1932 B1
Driefontein	ZW	1930 B3
Dunblane	ZW	1932 D2
Ebony Farm	ZW	1932 A1
Elim Mission, Inyanga	ZW	1732 D2
Empress Mine	ZW	1829 A4
Engwa	ZW	1932 B4
Erego	MO	1637 A1
Esigodini (formerly Essexvale)	ZW	2028 B4
Essexvale (now Esigodini)	ZW	2028 B4
Estatuane	MO	2632 A3
Fairfield	ZW	1930 B3
Fambani	MO	1835 B4
Featherstone	ZW	1830 D2
Fern Valley (Mutare)	ZW	1932 B1
Fishan, Gonarezhou N.P.	ZW	2132 A3
Fort Hill (now Chitipa)	MA	0933 C2
Fort Jameson (now Chipata)	ZA	1332 D1
Fort Johnston (now Mangochi)	MA	1435 A4
Four Rivers Camp	BO	1923 A1
Francistown	BO	2127 B1
Fwambo	ZA	0831 D3
Gairezi Bridge	ZW	1832 B2
Garuso	MO	1833 C3
Gatooma (now Kadoma)	ZW	1829 B4
Gem Farm	ZW	2129 D4
Ghanzi	BO	2121 D1
Gleneagles	ZW	1832 B4
Gokwe	ZW	1828 B2
Gomodimo Pan	BO	2223 D2
Gondola–Gorongoza Pontoon/Bridge	MO	1834 C3
Gorongoza Mountain	MO	1834 A3
Great Zimbabwe	ZW	2030 B4
Gumare	BO	1922 A3
Gumba	MO	1933 D4
Guro	MO	1733 A4
Guruve (formerly Sipolilo)	ZW	1630 D1
Gwamayaya River	ZW	1828 D1
Gwanda	ZW	2029 C3
Harare (formerly Salisbury)	ZW	1731 C3
Haroni Forest	ZW	2033 A1
Haroni River	ZW	2033 A1
Haroni–Rusitu Confluence	ZW	2033 A1
Hayfield B	ZW	2032 B2
Highlands	ZW	1731 C3
Hippo Valley	ZW	2131 B1
Hunyani	ZW	1730 D4
Hwange (formerly Wankie)	ZW	1826 A4
Ikelenge	ZA	1124 A2
Ikomba	ZA	0932 A2
Inchope	MO	1933 B2
Inhaca Island	MO	2632 B2
Inhaminga	MO	1835 A3
Inhassoro	MO	2135 C1
Inyanga	ZW	1832 B1
Inyanga National Park	ZW	1832 B
Inyangani Mountain	ZW	1832 B4
Inyati	ZW	1928 D2
Inyazura (now Nyazura)	ZW	1832 C1
Irisvale	ZW	2029 C1
Jalopi Bridge, Hwange	ZW	1826 B3
Jersey Estate	ZW	2032 B3
Juliasdale	ZW	1832 B3
Kabwe (formerly Broken Hill)	ZA	1428 A4
Kachalola	ZA	1430 D1
Kadoma (formerly Gatooma)	ZW	1829 B4
Kafue	ZA	1528 C3
Kaitano	ZW	1631 B3
Kalabo	ZA	1422 D3
Kalichero	ZA	1332 C2
Kalikali	ZA	1332 B2
Kalomo	ZA	1726 A2
Kampoti Rapids	ZW	1529 D2
Kangyane Pan	BO	2322 C4
Kanjanjesi Hills	ZA	1332 B1
Kampani	ZW	1826 B4
Kaotwe Pan (now Kgaotwe Pan)	BO	2223 C2
Kariba	ZW	1628 D2
Karoi	ZW	1629 D3
Karonga	MA	0933 D4
Kasama	ZA	1031 A1
Kasane	BO	1725 C3
Kasempa	ZA	1325 B4
Kasungu	MA	1333 A2
Kasusu	ZA	1626 C4
Katete	ZA	1432 A1
Katima Mulilo	CA/ZA	1724 A3
Katombora	ZA	1725 C4
Kaungashi River	ZA	1426 A2
Kazuma Pan	ZW/BO	1825 B3
Kazungula	ZW/ZA	1725 C4
Kgaotwe Pan (formerly Kaotwe Pan)	BO	2223 C2
Khumaga	BO	2024 B3
Khwai Camp, Lodge, River, Pan	BO	1923 B1
Kilimani	ZW	1932 D4
Kondolilo Falls	ZA	1330 B2

Locality	*Country*	*Quarter-degree Grid Reference*
Kondowe	MA	1034 C1
Kongwe Hill	ZA	1332 B2
Kotwa	BO	1632 D3
Kutama Mission	ZW	1730 C4
KweKwe (formerly Que Que)	ZW	1829 D4
Kwikampa	BO	1824 B4
Lake Alexander	ZW	1832 D3
Lake Chila	ZA	0831 C4
Lake Chiwondo	MA	1033 B2
Lake Kyle	ZW	2031 A1
Lake McIlwaine	ZW	1730 D4
Lamego	MO	1934 A4
Lealui	ZA	1523 A1
Leopard Rock (Vumba Mountains)	ZW	1932 B2
Lephepe	BO	2325 B4
Lifupa Camp, Kasungu N.P.	MA	1333 A1
Likabula River	MA	1535 D3
Lilongwe	MA	1333 D4
Limbe	MA	1535 C3
Limphasa Dambo	MA	1134 C1
Linkwasha Vlei	ZW	1827 C3
Linyanti Swamp	CA	1823 B3
Lirangwe River	MA	1534 B4
Livingstone	ZA	1725 D4
Livingstonia	MA	1034 C1
Liwonde	MA	1535 A1
Lobatse	BO	2525 B1
Lochinvar Ranch	ZA	1527 C3
Longueville Ranch	ZW	2028 D4
Lower Mtarazi River	ZW	1832 D2
Luala River Bridge	MO	1635 B4
Luangwa Bridge	ZA	1430 C3
Lucheche	ZA	?
Luembwe	ZA	1430 A4
Lujeri	MA	1635 B1
Lukasashi River	ZA	1430 A3
Lukona	ZA	1522 B4
Lundi River Bridge	ZW	2030 D4
Lupande/Nyamodzi Confluence	ZA	1331 D2
Lupane	ZW	1827 D4
Lusaka	ZA	1528 A4
Lusangazi	ZA	1331 B3
Lusulu	ZW	1827 B2
Mabalauta F.S. Gonarezhou N.P.	ZW	2131 C4
Mabeleapodi	BO	2022 C4
Mabausehube Pan	BO	2522 A1
Macheke	ZW	1831 B2
Machinawa Pan, Gonarezhou N.P.	ZW	2132 A4
Machipanda	MO	1832 D3
Macia	MO	2533 A1
Macuti, Beira	MO	1934 D4
Maforga	MO	1933 B1
Magasso	MO	1633 C3
Magogaphate	BO	2128 C2
Magude	MO	2532 B1
Magune Pan	ZW	2231 B1
Mahenya	ZW	2132 A4
Mahupa waterhole	BO	1921 A1
Main Camp, Hwange	ZW	1826 D2
Maiyumba	ZA	1232 C1
Majinji Pan	ZW	2231 A2
Makado	ZW	2129 B3
Makoka A.R.S.	MA	1535 C1
Makosa	ZW	1631 D1
Makurupini River	ZW	2033 A1
Makuti	ZA	1629 A3
Malanguene	MO	2134 B4
Malapati Drift	ZW	2231 A2
Maleme Dam	ZW	2028 D1
Malikango	ZW	2131 C2
Malonga River Bridge	ZW	1826 B4
Malugwe Pan, Gonarezhou N.P.	ZW	2131 D2
Mana Pools	ZW	1529 C2
Manga	MO	1934 D4
Mangochi (formerly Fort Johnston)	MA	1435 A4
Mangula (now Mhangura)	ZW	1630 C3
Manzituba Marsh, Chizarira N.P.	ZW	1727 D2
Manzituba Camp	ZW	1727 D2
Mapoff	ZW	1932 B2
Mapulanguene	MO	2432 A3
Maputo	MO	2532 D3
Marandellas (now Marondera)	ZW	1831 B1
Mare Dam	ZW	1832 B4
Marhumbini, Gonarezhou N.P.	ZW	2132 A4
Marondera (formerly Marandellas)	ZW	1831 B1
Martins Falls	MO	1933 C3
Masalanyane Pan	BO	2022 D1
Masieni	MO	2533 B1
Massangena	MO	2132 D2
Massinga	MO	2335 A4
Matipa Forest	MA	0933 C2
Matopos	ZW	2028 A4
Matowa Hill	ZW	1732 B1
Matusandona N.P.	ZW	1628 D3
Maun	BO	1923 C4
Mavita	MO	1933 C1
Mayau River	ZA	1224 C4
Mazoe	ZW	1730 D2
Mbala (formerly Abercorn)	ZA	0831 C4
Melfort	ZW	1731 C4

Locality	*Country*	*Quarter-degree Grid Reference*
Meponduine	MO	2531 D4
Metambanhe	MO	2034 D1
Metsemotlhaba River	BO	2425 D2
Metuchira	MO	1933 B2
Mfuwe	ZW	1331 B2
Mgwalaati Farm	ZA	1731 D2
Mhanda Mountain	MO	1833 B1
Mhangura (formerly Mangula)	ZW	1630 C3
Miami	ZW	1629 D2
Mikolongwe	MA	1535 C3
Misuku Hills (East)	MA	0933 D1
Misuku Mountains	MA	0933 C2
Mitucué Mountain	MO	1436 D1
Mkanda	ZA	1332 D2
Mlanje (now Mulange) Mountain	MA	1535 D3
Mnema	MA	1334 C2
Moamba	MO	2532 C1
Monte Cassino	ZW	1831 B2
Monze	ZA	1627 A4
Morrumbala	MO	1735 B3
Morrumbala Mountain	MO	1735 A4
Mossuril	MO	1440 D3
Motsobonye Pan	BO	2423 A1
Mount Darwin	ZW	1631 D3
Mount Hampden	ZW	1730 D2
Mount Selinda	ZW	2032 B3
Mozambique Island	MO	1540 B1
Mpatamanga Gorge	MA	1534 D1
Mporokoso	ZA	0930 A3
Mrewa (now Murewa)	ZW	1731 D2
Msandile Camp	ZA	1332 B3
Msari River	ZW	2031 A1
Msoro	ZW	1632 D3
Mtimbuka	MA	1435 A3
Mtoko (now Mutoko)	ZW	1732 A3
Muandzane	MO	2632 A3
Mubagwashe, Nyajena C.L.	ZW	2031 C1
Muchinga Escarpment	ZA	1331 A3
Muda	MO	1934 A4
Muda–Lamego	MO	1934 A4
Mugeba	MO	1637 C1
Mugesse Forest	MA	0933 D1
Mulanga	ZA	1625 C4
Mulanje Mountain (formerly Mlanje)	MA	1535 D3
Mulosa	MA	1635 B1
Mumbwa	ZA	1427 C3
Mungari	MO	1733 B1
Munyamadzi River	ZA	1232 A3
Murewa (formerly Mrewa)	ZW	1731 D2
Musami	ZW	1731 D4
Musapa Gap	MO	1932 D2
Musirizwi River	ZW	2032 B3
Mutare (formerly Umtali)	ZW	1832 D3
Mutoko (formerly Mtoko)	ZW	1732 A3
Muyako	CA	1724 C4
Muzuma River, Gwembe	ZA	1727 A4
Mvurwi (formerly Umvukwes)	ZW	1730 B2
Mwenezi (formerly Nuanetsi)	ZW	2130 B3
Mweru Wantipa	ZA	0829 D2
Mzimba	MA	1133 D3
Mzuzu	MA	1134 A3
Nabaunama Dam	MO	1538 B4
Namaacha	MO	2532 C3
Nata	BO	2026 A1
Navisikana Road, Gonarezhou N.P.	ZW	2131 D2
Nchalo	MA	1634 B2
Nchenachena	MA	1034 C3
Ndola	ZA	1228 D3
Ngara	MA	1034 A1
Ngoma, Kafue N.P.	ZA	1525 D4
Ngorima C.L.	ZW	2032 B2
Nkana	ZA	1228 C3
Nkhata Bay	MA	1134 C2
Nkhota Kota	MA	1234 C4
Nkonjera Mountain	MA	1033 D4
Nkwadzi Hill Forest	MA	1134 C1
Nokaneng	BO	1922 C1
Noro Dam	ZW	1631 D2
Nottingham Ranch	ZW	2229 B1
Nova Sofala	MO	2034 B1
Nsanje (formerly Port Herald)	MA	1635 C4
Nsombo	ZA	1029 D4
Ntabambomvu Hills, Gonarezhou N.P.	ZW	2131 D3
Ntchisi Mountain	MA	1334 A3
Nuanetsi River & Bridge	ZW	2130 B3
Nyadekese Dam	ZW	1631 D2
Nyakasikana	ZW	1629 A2
Nyamandhlovu	ZW	1928 C4
Nyamandhlovu Pan, Hwange	ZW	1826 D4
Nyamazi	ZW	1832 B3
Nyamkolo (also Niamkolo)	ZA	0831 C1
Nyampanda	ZW	1632 D4
Nyamugwe Pans	ZW	2131 D3
Nyamuweni Pan	ZW	1629 B1
Nyamwanga Farm	ZW	1731 B3
Nyanyana Confluence, L. Kariba	ZW	1628 D2
Nyazura (formerly Inyazura)	ZW	1832 C1
Nyika Plateau	MA	1033 D2
Nyika Plateau	ZA	1033 D1
Nyungwe	MA	1034 A3
Odzani	ZW	1832 D1
Old Umtali	ZW	1832 D3

Locality	Country	Quarter-degree Grid Reference
Old Sangwali	CA	1817 B3
Pachanza	ZW	1631 B4
Palapye Road	BO	2227 C1
Palm Beach	MA	1435 A3
Pambarra	MO	2135 C3
Patchway Mine	ZW	1829 B2
Penhalonga	ZW	1832 D3
Petauke	ZA	1431 A4
Plumtree	ZW	2027 B4
Ponta do Calichane	MO	2632 A1
Ponta do Ouro	MO	2632 D4
Port Herald (now Nsanje)	MA	1635 C4
Pungwe Gorge	ZW	1832 B4
Pungwe View	ZW	1832 B4
Quelimane	MO	1736 D4
Que Que (now KweKwe)	ZW	1829 D4
Ranelia Farm	ZW	1932 B3
Razi Dam	ZW	2030 D1
Ressano Garcia	MO	2531 B4
Ribáuè	MO	1438 C4
Ruda River	ZW	1832 B4
Rukomeshe R.S.	ZW	1529 C3
Rukute Farm	ZW	1630 C3
Rumpi	MA	1133 B2
Ruo River	MA	1635 B1
Rupisi Hot Springs	ZW	2032 A4
Rusape	ZW	1832 C1
Ruware	ZW	2031 D1
Sabi/Lundi Confluence	ZW	2132 A4
Saffron Waldon	ZW	1730 D4
Salisbury (now Harare)	ZW	1731 C3
Salujinga	ZA	1024 C3
Sandaula Plain	ZA	1522 B4
Savane	MO	1935 C1
Sayiri	ZA	1332 C4
Selborne Estates	ZW	1832 D1
Sena	MO	1735 A3
Sengwa Gorge & R.S.	ZW	1828 A1
Sengwa River at 790 m	ZW	1728 C3
Sepopa	BO	1822 C1
Sesheke	ZA	1724 A4
Shakawe	BO	1821 B4
Shangani River	ZW	1828 D3
Shapi Pan, Hwange N.P.	ZW	1826 D3
Shashi Irrigation Scheme	ZW	2229 A2
Shashi/Shashani Confluence	ZW	2128 D2
Shashi/Simukwe Confluence	ZW	2128 C2
Sheba	ZW	1832 D4
Shorobe	BO	1923 D3
Shumba Pan, Hwange N.P.	ZW	1826 C4
Silverstreams	ZW	1932 D3
Sipolilo (now Guruve)	ZW	1630 D1
Smalldeel	ZW	1923 D3
Solusi	ZW	2028 A1
Somabhula	ZW	1929 D1
Sote Source	ZW	1931 A3
Stapleford Forest Reserve	ZW	1832 D2
Tamafupa	BO	1926 A3
Teaklands	ZW	1927 B4
Tete	MO	1633 B1
The Corner	ZW	1932 D2
Thorn Park, Harare	ZW	1731 C1
Thyolo (formerly Cholo)	MA	1635 A1
Thyolo Mountain (formerly Cholo)	MA	1635 A1
Tobane	BO	2127 D4
Titumi (now Tutume)	BO	2027 C1
Tokwe Bridge	ZW	2030 B3
Toronto	ZW	1832 D3
Tshesebe	BO	2027 D1
Tshilonyane Pan	BO	2023 A3
Tutume (formerly Titumi)	BO	2027 C1
Tynwald	ZW	1730 D4
Udu Dam	ZW	1832 D3
Ume Confluence	ZA	1628 C4
Umfuli River Bridge	ZW	1830 A1
Umtali (now Mutare)	ZW	1832 D3
Umvukwes (now Mvurwi)	ZW	1730 B2
Vanduzi	MO	1833 C4
Van Niekerk Ruins	ZW	1832 B1
Victoria Falls	ZW/ZA	1725 D4
Vila Bocage	MO	1735 A4
Vila Fontes	MO	1735 C4
Vila de Manica	MO	1832 D4
Vila Franca do Save	MO	2134 B1
Vila Junqueiro	MO	1536 B4
Vila Paiva de Andrada	MO	1834 C1
Vila Pery	MO	1933 A2
Viola	MO	1633 C2
Vloorskop	BO	2520 D4
Vumba Mountain	ZW	1932 B2
Wankie (now Hwange)	ZW	1826 A4
Warren Hills	ZW	1730 D4
Watsomba	ZW	1832 D1
Xade Pan	BO	2223 A3
Xaxaba	BO	1923 C1
Xhenga Island	BO	1923 C2
Xiluvo	MO	1934 A1
Zambezi/Chewore Confluence	ZW	1529 D2
Zimba	ZA	1726 A3
Zimunya C.L.	ZW	1932 B1
Zinave	MO	2133 B4
Zivanga	MO	2133 B4
Zomba & Zomba Plateau	MA	1535 A4